Wellcome Trust Biomedical Vacation Scholarship Scheme at King's College London

Project Catalogue

Summer 2024

PROJECTS listed under Wellcome Trust Discovery Research Funding Remit categories

Burden of disease and its determinants, where this brings new and transformational knowledge

Complexities of human health and disease, including clinical and population-based approaches

Development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

Fundamental processes that underpin biology, to understand more about how life works

Needs, values and priorities of the people and communities affected by disease and health disparities

Social, cultural, political and historical contexts of human health and disease

burden of disease and its determinants, where this brings new and transformational knowledge		

2024_01 Unravelling Shigella Persistent Infections in a Zebrafish Infection Model

Supervisor:	**Dr Vincenzo Torraca**	vincenzo.torraca@kcl.ac.uk
Website:	https://www.kcl.ac.uk/research/torraca-group; https://kclpure.kcl.ac.uk/portal/en/persons/vincenzo.torraca	
Affiliated Lab:	Principal Investigator - Persistent infections and antimicrobial resistance	
Campus:	Guy's;	

Aims and Research Questions of the Project:

Shigella is a major human pathogen causing millions of illnesses and thousands of deaths every year. Persistent Shigella infections are an emerging concern. Not all patients infected with Shigella fully clear the infection, and some patients carry the infection for weeks or months. We have recently developed a model to study Shigella persistent infection in zebrafish larvae. Using this system has already helped identify new factors that contribute to the establishment of Shigella persistent infection.

In this project, we will study different Shigella mutants in zebrafish and compare the course of infection with these mutants to wild-type bacteria. This will allow us to determine to what extent individual Shigella factors contribute to the establishment of persistent infections.

Our results will contribute to explaining how Shigella persists in a living host. Since persistent infections are also difficult to treat with antibiotics, this work will also be valuable for developing new therapies.

Prerequisite Skills or Academic Background Required:

Suitable for undergraduates that have studied (or are studying) at least one Microbiology or Immunology related Module

complexities of human health and disease, including clinical and population-based approaches		
2024_02 Characterising and modelling cell heterogeneity in keloid scars		
Supervisor:	**Dr Tanya Shaw**	tanya.shaw@kcl.ac.uk
Website:	https://www.kcl.ac.uk/research/shaw-lab	
Affiliated Lab:	Principal Investigator - Tissue Repair & Regeneration	
Campus:	Guy's;	

Aims and Research Questions of the Project:

It is widely appreciated that fibroblasts are heterogeneous, which is based in part on extensive single cell (sc)RNAseq analyses. There are distinct subtypes whose percentages are altered in several fibrotic conditions, including keloids. This has led to the hypothesis that enrichment of specific subset(s) underpins the pathologies, and therefore targeting specific fibroblast subtypes may be a therapeutic avenue. Although most research on human fibroblasts uses undefined primary fibroblasts there are unanswered questions about the cell subset(s) represented. This project aims to:

- Validate the cellular diversity in primary tissue samples.
- Focusing on stromal sub-populations, develop methods for mono- and multi-cell culture studies.
- Time permitting, create cell-derived matrix models to characterise the distinct extracellular matrix produced by different stromal sub-populations in normal skin vs keloid scars.
- Ultimately, these cell-derived matrices will be used to study the effects of the different substrates on key cell populations in the skin.

Prerequisite Skills or Academic Background Required:

Suitable for students on any of the Bioscience degrees

complexities of human health and disease, including clinical and population-based approaches		

2024_03 In vivo assessment of novel cell therapies for peripheral vascular disease

Supervisor:	**Alexander Kerr**	ashish.patel@kcl.ac.uk
Website:	https://www.kcl.ac.uk/scmms/our-themes/vascular	
Affiliated Lab:	PhD student developing novel advanced therapies for the treatment of peripheral vascular disease, with Dr Ashish Patel	
Campus:	St Thomas';	

Aims and Research Questions of the Project:

An exciting new field of regenerative medicine is cell and gene therapies, or 'Advanced Therapies', and the Academic Department of Vascular Surgery, St Thomas' Hospital, has been developing novel cell therapies for the treatment of blocked arteries for over 15 years. The aim of these 'living medicines' is to grow new blood vessels within the limbs of patients for whom surgical options have been exhausted.

In a pre-clinical in vivo model of limb ischaemia, we inject different candidate Advanced Therapies into the ischaemic limbs of mice. The purpose of this Scholarship is to assess the success of these therapies by quantifying the growth of new blood vessels in the lower limb muscles of mice, and will involve the following techniques: cryosectioning of frozen muscle biopsies; immunohistochemical staining; imaging using fluorescence/confocal microscopy; use of specialist software to analyse the images for new blood vessel growth; statistical analysis and presentation of the data.

Prerequisite Skills or Academic Background Required:

No restrictions, all backgrounds welcome

complexities of human health and disease, including clinical and population-based approaches		

2024_04 Investigating a Redox Regulation of Cell Cycle Proteins: Implications for Proliferative Diseases

Supervisor:	**Dr Olena Rudyk**	olena.rudyk@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/olena-rudyk; https://kclpure.kcl.ac.uk/portal/en/persons/olena.rudyk	
Affiliated Lab:	Principal Investigator in Pulmonary Redox Vascular Biology Lab	
Campus:	St Thomas';	

Aims and Research Questions of the Project:

Vascular remodelling, a structural alteration of blood vessels that adversely affects their function and structure, plays a central role in the pathogenesis of cardiovascular disease, including atherosclerosis, systemic arterial hypertension, coronary artery disease, and pulmonary hypertension. Cell cycle dysfunction, increased oxidant production, and altered metabolism can cause hyper-proliferative vascular diseases and cancer-like processes. Understanding their link is crucial for developing therapeutics to halt cell growth and/or reverse vascular remodelling. While often considered harmful, oxidants produced due to cell metabolic activity may mediate redox signalling and prevent maladaptive disease progression by reversible redox modifications of proteins. The student will join Rudyk's lab, which studies functionally relevant reversible oxidative modifications in cyclin-dependent kinases and their role in disease (PMID: 37955182; PMID: 33788196). The project offers basic lab training in cell biology/biochemistry/pharmacology routinely used in the lab (e.g., cell culture/proliferation and/or migration assays, immunoblotting, confocal imaging), quantitative (statistics/data analysis), presentation and critical thinking skills.

Prerequisite Skills or Academic Background Required:

This project will be suitable for Biochemistry, Biomedical Sciences, Physiology, and Pharmacology undergraduates or any students with a similar background.

complexities of human health and disease, including clinical and population-based approaches		

2024_05 Investigating the role of titin missense variants in muscle disease

Supervisor:	**Dr Martin Rees and Dr Ay Lin Kho**	martin.rees@kcl.ac.uk ay.kho@kcl.ac.uk
Website:	https://www.kcl.ac.uk/research/gautel-group	
Affiliated Lab:	Post-doctoral researchers within Professor Mathias Gautel's molecular cardiology laboratory.	
Campus:	Guy's;	

Aims and Research Questions of the Project:

Titin is a massive, multi-domain protein that traverses half a sarcomere, the basic unit of contractile muscle. Missense variants in titin have been linked to various muscle diseases, with many of the variants reducing the stability of their domain when assayed in vitro. We have an expanding collection of titin missense variants from different disease cohorts and are investigating whether they contribute to the patients' disease. To help answer this question, we aim to (i) produce individual wild type and variant titin domains and measure their thermal stability and (ii) transfect these domains into cells and observe their expression pattern, with the prediction that disease-linked variants will reduce their domains' thermal stability and result in aggregated protein expression in cells. This project will introduce students to various laboratory techniques such as polymerase chain reaction, cloning, protein expression and purification, differential scanning fluorimetry, light microscopy and cell culture.

Prerequisite Skills or Academic Background Required:

This project is only suitable for Biochemistry and Biomedical Science undergraduates

complexities of human health and disease, including clinical and population-based approaches		

2024_06 Quantitative analysis of paediatric clinical neurophysiology data to interrogate human brain development

Supervisor:	**Dr Kimberley Whitehead**	kimberley.whitehead@kcl.ac.uk
Website:	https://kclpure.kcl.ac.uk/portal/en/persons/kimberley.whitehead	
Affiliated Lab:	Principal Investigator - Paediatric clinical neurophysiology	
Campus:	Waterloo;	

Aims and Research Questions of the Project:

My research programme relates to neonatal and paediatric neurology. I typically study physiological signals over time, including from the brain (electroencephalography, EEG), and the brain-heart axis (heart-rate and heart-rate variability from electrocardiography, ECG). I also analyse associated data which give insight into how the brain is developing, including head circumference growth.

You will use my large existing dataset of deidentified clinical data to work on one aspect of my ongoing research programme.

I work across multiple clinical and academic sites as well as from home. We will have weekly in-person progress meetings at James Clerk Maxwell Building, and you will be invited to join me at in-person seminars, journal clubs etc.

Prerequisite Skills or Academic Background Required:

This project would be an ideal opportunity for a student from science, technology or engineering to apply their quantitative skills to a clinically important topic, and gain experience of inter-disciplinary research. Coding skills in Matlab, R, or Mathematica would be highly advantageous.

complexities of human health and disease, including clinical and population-based approaches		

2024_07 The role of N-acetylcysteine, γ-glutamylcysteine and glutathione in Parkinson's Disease – A Systematic Review

Supervisor:	**Dr Yemisi Latunde-Dada**	yemisi.latunde-dada@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/yemisi-latunde-dada	
Affiliated Lab:	Principal Investigator - Iron nutrition and metabolism	
Campus:	Waterloo;	

Aims and Research Questions of the Project:

Studies have suggested that nutritional factors or components have benefits for neurodegenerative disorders. However, the reported outcomes are conflicting and inconsistent. The study aims to search the literature to understand what type of nutritional components/ therapies are shown to improve the neurodegenerative disorders patients' health. It intends to synthesize the literature on available nutritional treatment and the risk of neurodegenerative disorders by conducting a systematic review. This will employ the PRISMA and Cochrane Review guidelines for systematic reviews and meta-analyses. It will involve online database searches (e.g., Medline, PubMed, Mendeley etc), selection of relevant studies, data extraction into an Excel spreadsheet, assessment of the quality of the studies, and data synthesis and statistical analysis using appropriate software such as the Review Manager. The study will therefore consolidate available evidence and propose recommendations on nutritional intervention study designs to inform future trials to improve the health of patients with neurodegenerative disorders.

Prerequisite Skills or Academic Background Required:

his project will only be suitable for nutrition and biomedical undergraduates.

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_08 7 Tesla MRI Body Imaging for cancer detection

Supervisor:	**Dr Ozlem Ipek**	ozlem.ipek@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/ozlem-ipek	
Affiliated Lab:	Magnetic Resonance Imaging Engineering	
Campus:	St Thomas';	

Aims and Research Questions of the Project:

Prostate cancer is the commonest male cancer. Multiparametric MRI of the prostate on 1,5T or 3T scanners has become established as the initial tool for detection and staging of tumour as well as for guiding intervention. However, ceiling sensitivity for tumour detection is in the order of 80%; a significant proportion of lesions remain undetected or are indeterminate on imaging. Therefore, further improvements are still required to MRI. 7T MRI offers the opportunity for a step change by its higher sensitivity and specificity for tumour detection through higher contrast and signal-to-noise; and characterisation through comprehensive tumour information.
We recently built a 10-channel dipole transmit and 30-channel loop receive array for 7T Torso imaging mainly targeting the kidney, prostate and hip. This project aims to further develop our first body coil for 7T imaging that will enable the first comprehensive non-invasive in vivo imaging of human body tissue microstructural, molecular and vascular imaging.

Prerequisite Skills or Academic Background Required:

Student with interest/background in Engineering and biomedical sciences

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_09 Deterministic stress enhanced reduced order models to augment cardiovascular magnetic resonance imaging

Supervisor:	**Dr Richard Jefferson-Loveday**	Richard.jefferson-loveday@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/richard-jefferson-loveday	
Affiliated Lab:	Principal Investigator - Computational Fluid Dynamics	
Campus:	Strand;	

Aims and Research Questions of the Project:

Commonly haemodynamic studies use Reynolds Averaged Navier-Stokes (RANS) methods however these assume all flow structures and scales are of a stochastic nature which is an invalid assumption and therefore often leads to inaccurate results or requires careful choice of model and calibration for specific flow cases. Typically, they are unable to accurately account for transition and turbulent flow. This project will extract deterministic flow information from high-fidelity time-dependant simulations in the form of 'deterministic stresses' and use these to supplement fast RANS simulations to greatly improve accuracy. Following proof of concept, it is intended to use trained neural networks to provide the deterministic components precluding the need for additional simulations.

Prerequisite Skills or Academic Background Required:

Experience of Fluid Dynamics. Programming experience beneficial.

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_10-a Swallowing classification based on the fusion of EMG and sound signals

Supervisor:	**Xin Chen**	xin.7.chen@kcl.ac.uk
Website:	https://xinqibao517.wixsite.com/mysite; https://kclpure.kcl.ac.uk/portal/en/persons/xin-chen-2	
Affiliated Lab:	PhD student within Professor Ernest Kamavuako's Biosignals and Sensors Laboratory	
Campus:	Strand;	

Aims and Research Questions of the Project:

This project aims at classifying the swallowing activities of solid, fluid and saliva using the signal of EMG and sound with machine learning techniques. The dataset will be ready for students to conduct data processing and further interpretation.

The research questions include:

1. How can time-domain, frequency-domain, and time-frequency domain features extracted from EMG and sound signals be utilized to distinguish between swallowing activities?
2. Which of the machine learning algorithms (e.g., SVM, Neural Networks, Decision Trees) offer the highest accuracy and efficiency in classifying swallowing types based on sound/EMG signals?
3. Does the fusion of EMG and sound signal improve the classification results? And what are the best practices for integrating these multimodal data sources?
4. What are the challenges in implementing these classification models for real-time monitoring of swallowing activities, and what strategies can be employed to address these challenges?

Prerequisite Skills or Academic Background Required:

This project will only be suitable for students with experience on signal processing, machine learning, and familiar with MATLAB or Python.

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_10-b Fluid Intake Classification and Estimation using Neural Networks

Supervisor:	**Iman Ismail**	iman.a.ismail@kcl.ac.uk
Website:	https://xinqibao517.wixsite.com/mysite https://kclpure.kcl.ac.uk/portal/en/persons/iman-ahmed-ismail	
Affiliated Lab:	PhD student within Professor Ernest Kamavuako's Biosignals and Sensors Laboratory	
Campus:	Strand;	

Aims and Research Questions of the Project:

This project aims to classify the fluid intake from saliva using the Electromyography sensor and Neural Networks.
The research questions include:
1. What are the best EMG features that can be extracted to distinguish between fluid and saliva?
2. What are the best EMG features that can be extracted to estimate the fluid intake volume?
3. Will the Neural Networks produce better results compared to the other machine learning algorithms in classifying and estimating fluid intake?
4. Which will yield superior performance with Neural Networks: features extracted from raw data or the raw data itself?

Prerequisite Skills or Academic Background Required:

This project will only be suitable for students with experience on signal processing, machine learning, and familiar with Python or Matlab

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research		

2024_11 Modelling a magnetic drug delivery system based on bulk superconductors

Supervisor:	**Mr Zhenyang Xu- Dr Mark Anislie**	zhenyang.xu@kcl.ac.uk - mark.ainslie@kcl.ac.uk
Website:	https://kclpure.kcl.ac.uk/portal/en/persons/mark.ainslie	
Affiliated Lab:	PhD student within Dr. Ainslie's Superconducting Technology + Cryogenics Research Group	
Campus:	Strand;	

Aims and Research Questions of the Project:

Magnetic drug targeting (MDT) is one of the most effective methods for drug delivery for cancer therapy. Bulk superconducting magnets can act as very powerful pseudo-permanent magnets, providing fields above 3 T (conventional permanent magnets are usually less than 1 T). They have the potential to provide sufficient magnetic field strength and gradient to guide magnetic drugs from outside of the body. Some research in this area has been carried out to date, but it has been based on simple experiments or two-dimensional numerical simulations, which has been hard to translate into the practical design of superconducting MDT systems. In this project, the student will develop a three-dimensional numerical model that can be used to simulate the drug delivery process via this kind of superconducting magnet. They will then investigate the capture efficiency of the magnetic particles (drugs) using the model, which will provide valuable insights for the design of a practical in vitro superconducting MDT system

Prerequisite Skills or Academic Background Required:

None listed

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_12 NMR Kinase: mediator between force production in muscle and metabolism?

Supervisor:	**Mark Pfuhl**	mark.pfuhl@kcl.ac.uk
Website:	https://www.kcl.ac.uk/research/pfuhl-group	
Affiliated Lab:	Structural biology of muscle and regulatory proteins	
Campus:	Guy's;	

Aims and Research Questions of the Project:

NMR kinases play an important role in nucleotide (NADH) metabolism. While NMRK1 is expressed at the same level throughout, the expression of NMRK2 responds strongly to muscle activity. NADH is an important co-enzyme and metabolite which also plays a regulatory role. Dropping NADH levels are closely linked to end stage heart failure. In addition to its metabolic role NMRK2 is also binding to integrins and so offers the intriguing possibility to link regulation of metabolism and muscle activity. We want to study NMRK2 in vitro to better understand its enzymatic and interaction properties. To this end we will express and purify the protein and study it in vitro using various biophysical methods.

Prerequisite Skills or Academic Background Required:

Basic biological sciences background and curiosity

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_13 Novel blood biomarkers of atherosclerosis

Supervisor:	**Professor Albert Ferro**	Albert.ferro@kcl.ac.uk
Website:	https://www.kcl.ac.uk/research/ferro-lab	
Affiliated Lab:	Principal Investigator: Ferro group - Inflammation and Atherosclerosis	
Campus:	Waterloo;	

Aims and Research Questions of the Project:

Despite important advances in prevention and treatment, atherosclerotic cardiovascular diseases remain the most common causes of death and disability worldwide. In recent years, it has become increasingly clear that inflammation plays an important pathophysiological role in both atherogenesis and its complications. We have developed a novel plasma marker, based around a multiplex array assay of chemokines, cytokines and soluble adhesion molecules, which in a study of subjects free of clinically evident cardiovascular disease (n = 42), predicts carotid intima-media thickness as well as the presence of subclinical atherosclerotic plaque disease with high sensitivity and specificity. In this project, the student will undertake discovery proteomics in stored blood samples from these same subjects, to identify novel previously unidentified biomarkers of disease which can be incorporated into our existing panel and enhance its predictive ability.

Prerequisite Skills or Academic Background Required:

Biomedical science or medicine undergraduates

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_14 Simulating ultrasound data for next generation AI assisted imaging

Supervisor:	**Mr Yi Li, Dr Laura Peralta**	yi.8.li@kcl.ac.uk, laura.peralta_pereira@kcl.ac.uk
Website:	https://www.quiinlab.com/, https://kclpure.kcl.ac.uk/portal/en/persons/yi-li-2, https://kclpure.kcl.ac.uk/portal/en/persons/laura.peralta_pereira	
Affiliated Lab:	1: PhD student within Dr Laura Peralta's Quantitative Ultrasound Imaging & Interventions Lab; 2: PI - Quantitative Ultrasound Imaging & Interventions Lab	
Campus:	St Thomas';	

Aims and Research Questions of the Project:

Medical ultrasound stands to benefit greatly from data-driven deep learning techniques. However, training robust deep models relies on substantial datasets of ground truth, which can be impractical to acquire for diverse scanning scenarios. To address this, this project proposes using simulations to generate synthetic ultrasound data for beamforming model development. Specifically, the student will work with an effective ultrasound image simulation pipeline implemented in a MATLAB toolbox. By randomly sampling scatterer positions and imaging parameters, e.g. sampling frequency, resolution, they will simulate calibrated point scatter distributions and raw ultrasound channel data. This will mimic the input and output relationships of beamforming in real-world ultrasound.
In summary, this research uniquely utilizes simulations to unlock the power of data-demanding deep learning algorithms for medical ultrasound. Through this project, the student can gain valuable experience in simulation methodology in medical ultrasound, in order to assist in training deep learning models.

Prerequisite Skills or Academic Background Required:

The project is suited to students who have engineering/physics/mathematics background, and who would like to develop in-depth knowledge and skills in medical ultrasound simulation. Basic coding skills (especially in MATLAB) are preferred.

development of methodologies, conceptual frameworks, technologies, tools or techniques that could benefit health-related research

2024_15 Understanding the robustness of speech-based analyses for remote health assessment

Supervisor:	**Dr Nicholas Cummins, Dr Judith Dineley**	nick.cummins@kcl.ac.uk, judith.dineley@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/nicholas-cummins	
Affiliated Lab:	Precision Health Informatics Data Lab - Professor Richard Dobson	
Campus:	Denmark Hill;	

Aims and Research Questions of the Project:

Using mobile devices for recording, speech analysis has potential as a powerful and convenient remote monitoring tool in mental health and neurological conditions. However, to realise this, we need to understand and quantify factors that affect the reliability of speech-based systems. This project will help gain vital insights into sources of variations related to collecting speech using mobile devices. These sources include recording equipment, the acoustic environment and natural variations in our voices over time. Our broader research aim is to identify speech parameters which are less sensitive to known sources of variation and assess their impact on machine learning predictions of health state. The student will gain hands-on research experience assisting in speech data processing and organisation with the possibility to gain experience in other areas, such as machine learning and health informatics, and learn new computational skills relating to signal processing and data analysis.

Prerequisite Skills or Academic Background Required:

This project is multidisciplinary in nature and will be of particular interest to undergraduates in computer science, biomedical physics and engineering, and psychology. There is scope to tailor the project to the student's interests; the supervisors and student will set project outputs at the start of their stay to ensure they are consistent with the expectations and competencies of the student. Familiarity in programming languages such as R or Python would be an advantage but is not a strict requirement.

fundamental processes that underpin biology, to understand more about how life works

2024_16 Does CD39 genotype influence the tumour microenvironment in cutaneous T-cell lymphoma?

Supervisor:	**Dr. Christine Jones and Dr. Tracey Mitchell**	christine.l.jones@kcl.ac.uk and tracey.mitchell@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/tracey-mitchell	
Affiliated Lab:	Christine Jones: Translational research scientist in the skin tumour unit molecular diagnostics laboratory. Tracey Mitchell: Principal investigator - molecular genetics of cutaneous T-cell lymphoma.	
Campus:	Guy's;	

Aims and Research Questions of the Project:

Cutaneous T-cell lymphoma (CTCL) is a malignancy of mature skin-homing T-cells. The interplay between malignant cells and their microenvironment has not been well characterised in CTCL. CD39 is an ecto-enzyme, catalysing the initial step in the conversion of ATP to adenosine, which is overexpressed in a proportion of patients with CTCL. We have established that this overexpression is dependent on the genotype of a SNP within the CD39 locus and that CD39 genotype has prognostic value in patients who present over the age of 60. ATP plays an immune recruiting role when present in the microenvironment whilst adenosine plays an immune suppressive role, therefore overexpression of CD39 could alter the inflammatory status of the tumour. This project will measure the rate of extracellular ATP metabolism by ex vivo CD4+ T-cells from CTCL patients and determine whether CD39 genotype influences the rate of ATP metabolism by these cells.

Prerequisite Skills or Academic Background Required:

Suitable for undergraduates with a background in biomedical and related sciences.

fundamental processes that underpin biology, to understand more about how life works		

2024_17 Identification of GPCR-activating ligands secreted during pregnancy

Supervisor:	**Professor Shanta Persaud; Dr James Bowe**	shanta.persaud@kcl.ac.uk; james.bowe@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/shanta-persaud	
Affiliated Lab:	Principal Investigator - GPCR-mediated regulation of islet function	
Campus:	Guy's;	

Aims and Research Questions of the Project:

During pregnancy beta cell mass in the islets of Langerhans increases to maintain blood glucose levels despite maternal insulin resistance. The precise cues for beta cell mass expansion are unknown, but it is thought that the placenta secretes a range of bioactive peptides that act at G protein-coupled receptors (GPCRs) on beta cells to drive their proliferation and protect them from apoptosis. However, if there is an insufficient increase in beta cell number during pregnancy then hyperglycaemia and gestational diabetes may occur. We are using a luminescent assay (PRESTO-Tango) that quantifies GPCR activity and we plan to screen plasma from non-pregnant women, those with healthy pregnancy and those with gestational diabetes to determine whether we can define what stimulatory cues are missing in gestational diabetes.

Prerequisite Skills or Academic Background Required:

This project will be suitable for students with an interest in endocrinology and diabetes

fundamental processes that underpin biology, to understand more about how life works

2024_18 Investigating the role of a redox-regulated kinase in pulmonary vascular cell (dys)function

Supervisor:	**Dr Hannah Green**	hannah.l.green@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/olena-rudyk; https://kclpure.kcl.ac.uk/portal/en/persons/olena.rudyk	
Affiliated Lab:	Postdoctoral Research Associate in Dr Olena Rudyk's Pulmonary Redox Vascular Biology Lab	
Campus:	St Thomas';	

Aims and Research Questions of the Project:

Pulmonary hypertension (PH) is currently an incurable disease with poor survival rates (~50% survival 5-years post-diagnosis). Therefore, understanding the mechanisms underlying PH pathology is vital to identify new therapeutic targets. Oxidants are important signalling mediators in health, and alterations to cellular redox balance occur in many disease states, including PH, with adaptive or maladaptive consequences. One of the focuses of the Rudyk lab is to understand the role of redox-regulated proteins in the function and dysfunction of pulmonary vascular cells (endothelial, smooth muscle) that may contribute to the hyperproliferation, vasoconstriction and abnormal angiogenesis that are key features of PH. This project will offer training in many transferable in vitro laboratory skills such as cell culture, western blotting, immunocytochemistry and confocal microscopy, as well as software for image analysis, graphing and statistics.

Prerequisite Skills or Academic Background Required:

This project will be suitable for Biochemistry, Biomedical Sciences, Physiology, and Pharmacology undergraduates or any students with a similar background.

fundamental processes that underpin biology, to understand more about how life works

2024_19 Molecular logics of self-renewal and neurogenic characteristics of neural progenitors

Supervisor:	**Dr Setsuko Sahara**	setsuko.sahara@kcl.ac.uk
Website:	https://devneuro.org/cdn/group-overview.php?groupID=87	
Affiliated Lab:	Principal Investigator – Mechanisms of cortical neurogenesis	
Campus:	Guy's;	

Aims and Research Questions of the Project:

The size of organs and the number of cells within a tissue are primarily determined by the coordinated balance between self-renewal and differentiation properties of stem cells. This rule applies to the development of the cerebral cortex, the largest structure in the mammalian nervous system, which processes the information for our higher cognitive, motor and sensory tasks. In the developing cortex, a key transition from expansive to differentiating cell divisions of progenitors occurs when the progenitors called neuroepithelium cells differentiate into neurogenic progenitors, called radial glia.

In this project, the student will focus on decoding the molecular mechanisms that confer self-renewal or neurogenic potentials upon neural progenitors. Specifically, they will characterize gene expression profiles in vitro within ES-derived cortical progenitors under the control of our candidate genes.

Prerequisite Skills or Academic Background Required:

Basic knowledge of molecular biology and neuroscience is desirable

fundamental processes that underpin biology, to understand more about how life works

2024_20 The role of RNA regulation in the pathogenesis of motor neuron disease (MND)

Supervisor:	**Dr. Jernej Ule, Dr. Owen Gwydion James**	jernej.ule@kcl.ac.uk, Owen.Gwydion.James@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/jernej-ule	
Affiliated Lab:	Principal investigator and postdoc working on RNA regulatory networks in motor neuron disease.	
Campus:	Denmark Hill;	

Aims and Research Questions of the Project:

Mutations causing MND often perturb RNA-binding proteins or RNA elements. It is now possible to model the impact of these mutations via genetically modified induced pluripotent cells (iPSCs), which are differentiated into neurons. The project will contribute towards determining the sequence of molecular events initiated by disease mutations and leading to neuronal death – i.e., the temporal progression of molecular pathogenesis. We hypothesise that RNA deregulation is key from the earliest stages, which could define early therapeutic opportunities.

The project will use transcriptomic approaches with iPSC-derived neurons to address the question of how mutations in RNA binding proteins disrupt RNA regulation across the genome. Depending on student's past expertise and interests, this will involve culture of iNeurons, imaging or/and transcriptomic methods such as RNAseq and ribosome profiling, and/or computational biology. The student will be co-supervised by the postdoc Owen Gwydion James, an expert in studies of disease pathogenesis with iPSCs.

Prerequisite Skills or Academic Background Required:

the project will be suitable to students with varied backgrounds and interests in either (or all) of these: systems biology and transcriptomics, advanced cell and molecular biology, computational biology, modelling neurodegeneration with iPSC-derived neurons

fundamental processes that underpin biology, to understand more about how life works		

2024_21 Using machine learning to measure how mice climb in their home cage

Supervisor:	**Dr Alina-Cristina Marin**	alina-cristina.marin@kcl.ac.uk
Website:	https://www.franziskadenk.com/ and https://www.kcl.ac.uk/people/franziska-denk	
Affiliated Lab:	Postdoctoral Research Associate within Dr Franziska Denk's laboratory	
Campus:	Guy's;	

Aims and Research Questions of the Project:

Patients with pain in their limbs and joints often report difficulties climbing stairs or gripping objects. Laboratory animals, like mice, also climb – usually for fun in their home cage. We therefore might be able to assess changes in climbing behaviours as a result of pain. In our team, we are using computer vision and machine learning tools to measure climbing behaviour in the home cage over long periods of time.

Your job would be to help us with this. You would annotate videos of mice housed in the climbing cage, quantify climbing and compare different experimental groups and timepoints.

Beyond this aim, you will also be able to use your own initiative to ask further questions depending on your skills and interests. For example, you might want to explore the videos for other pain-relevant behaviours or compare different computational approaches.

Prerequisite Skills or Academic Background Required:

No must have skills for the core project - we will teach you everything you need to know. For the extra computational aspects, knowledge or a strong interest in computer programming would be beneficial.

needs, values and priorities of the people and communities affected by disease and health disparities		

2024_22 The cycle study: Exploring women's experiences of menstruation, contraception, and mental health

Supervisor:	**Dr Catherine Jones and Dr Helena Zavos**	catherine.2.jones@kcl.ac.uk and helena.zavos@kcl.ac.uk
Website:	https://www.kcl.ac.uk/people/kitty-jones	
Affiliated Lab:	Mental health, PMS and contraception research project	
Campus:	Denmark Hill;	

Aims and Research Questions of the Project:

The project is a collaboration between Dr Catherine Jones, Dr Helena Zavos and Dr Tom McAdams.
The project seeks to:

- Explore young women's mental health experiences in relation to menstruation and use of hormonal contraception
- Explore how young women address this in their daily lives such as through symptom management and support
- Scope what support is needed

Task 1 Pilot study development: the student will be involved in developing an ethics application, and designing interview questions and recruitment procedures for a qualitative project focusing on pre premenstrual symptoms and contraception use.
Task 2 Establish a lived experience advisory group: The advisory group will be important for providing feedback on the outputs of the pilot study and will inform all stages of the subsequent full study. Having the opportunity to establish the advisory group at the outset will enable an authentic use of co-production throughout the full study.

Prerequisite Skills or Academic Background Required:

Psychology, biology, or sociology student preferable.

social, cultural, political and historical contexts of human health and disease.		

2024_23 Prevalence of OptiBreech collaborative care practice within the United Kingdom National Health Service

Supervisor:	**Dr Shawn Walker**	Shawn.Walker@kcl.ac.uk
Website:	https://optibreech.uk/	
Affiliated Lab:	Principal Investigator -- Pregnancy and birth care for women with a breech-presenting baby	
Campus:	St Thomas';	

Aims and Research Questions of the Project:

What is the prevalence of OptiBreech collaborative care practice within the NHS? OptiBreech collaborative care is a bundle of evidence-based care practices combined into a multi-disciplinary care pathway for women with a breech-presenting baby at the end of pregnancy. We are aware that some Trusts have implemented some elements of this care pathway, but we are not sure which elements are currently being used to guide practice, to what extent, and in what areas of the UK. This project involves administering a survey of UK maternity units, which will help us to map this. The results will be used to inform recommendations around improvements in training to guide care in this area, and the expected costs of implementing OptiBreech collaborative care as the standard care pathway across the UK. The student will also contribute to an update of a systematic review of vaginal breech birth training evaluations.

Prerequisite Skills or Academic Background Required:

This project will be ideal for midwifery or medical students aiming for a career in perinatal care.

social, cultural, political and historical contexts of human health and disease.		

2024_24 Public Mental Health – international study

Supervisor:	**Dr Mariana Pinto da Costa**	mariana.pintodacosta@kcl.ac.uk
Website:	https://www.kcl.ac.uk/research/an-international-study-on-public-mental-health-work-opportunities-and-training	
Affiliated Lab:	Senior Lecturer - Department of Psychological Medicine	
Campus:	Denmark Hill;	

Aims and Research Questions of the Project:

This international study has aimed: i) To investigate the extent of public mental health work, opportunities, barriers, and training; ii) To identify key public mental health work opportunities and barriers for people from different parts of the world.

The data from this international cross-sectional survey has been collected and is available for the selected student to analyse, with the support of the supervisor.

This dataset includes the views of different key stakeholder groups, including mental health professionals, policymakers, public health professionals, primary care practitioners, medical students and people with lived experience of mental illness.

The student will use and strengthen skills on statistical analysis and presentation of the data.

There will be opportunities for the student to contribute to this study dissemination and article publication.

Prerequisite Skills or Academic Background Required:

This project would be particularly suitable for medicine, neuroscience or psychologyy undergraduates.