



Year 1 SSC 2013-14
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Research Projects

Do WAVEs cause prostate cancer to spread?

Institution: Cancer and Genetics

Department: Cardiff University-Peking University Cancer Institute

Tutor: Mrs Hoi Ping Weeks

Project Code: PGR01

Brief Project Aims:

Investigate the role of WAVE proteins on the aggressiveness of prostate cancer cells.

Educational Objectives:

- Basic understanding of prostate cancer epidemiology and cancer metastasis.
- Understand basic laboratory techniques e.g. use of pipettes and aseptic technique.
- Time management for planning experiments.
- Be able to interpret the experimental data and ultimately appreciate how the findings could be applied clinically.

SSC Practical Research Description:

Prostate cancer is the most common cancer to affect males in the UK. Even so, most prostate cancer tumours are slow growing and asymptomatic with the vast majority of prostate cancer related deaths attributed to the spread of cancers to distant sites in the body (metastasis). Metastatic cancers commonly exhibit uncontrolled cell migration; a basic cellular function in physiologically normal cells. Dynamic restructuring of the cell internal structure (cytoskeleton; comprised of actin filaments) drives cell migration and is stimulated by a protein complex called Arp2/3. Actin filament reorganisation is stimulated by Arp2/3 upon its activation by WAVE proteins. It is proposed that high levels of WAVE is a contributing factor in aggressive prostate cancers.

mTOR hyperactivation increases cellular stress through inhibition of autophagy

Institution: Institute of Cancer Genetics

Department: MEDIC PGR

Tutor: Miss Charlotte Johnson

Project Code: PGR02

Brief Project Aims:

To understand signaling in the mTOR pathway by carrying out a Western blot for multiple proteins within the mTOR pathway.

Educational Objectives:

- Students will investigate samples generated from tissue culture experiments aimed at investigating mTOR hyperactivation through inhibition of autophagy and the downstream consequences of this.
- Students will learn and understand the Western blot technique as well as an introduction to tissue culture and cell lines.
- Included in this are basic pipetting skills, using a spectrophotometer, and understanding protein signaling pathways.
- Groups will need to work as a team to interpret results and present data to their peers.

SSC Practical Research Description:

Students will perform a Bradford assay and Western blot on previously collected protein samples and interpret the data. Protein levels of p62, p-rpS6, and TSC2 will be investigated (with beta actin as a control for protein loading).

Additionally, each group will have the opportunity to do basic tissue culture with mouse embryonic fibroblast cell lines.

Group 1: Bradford assay, SDS Page, transfer & tissue culture.

Group 2: Antibody probing, blot development & tissue culture.

Group 3: As group 2 (duplicate blot)

Isolation, characterisation and assessment of antibodies in response to meningococcal vaccination.

Institution: Infection and Immunity

Department: School of Medicine

Tutor: Mr Scott Jones

Project Code: PGR03

Brief Project Aims:

Assess change in antibody titre over time to Nimenrix vaccination by generating a standard using immune plasma.

Educational Objectives:

- Students will gain a good understanding in meningococcal disease and the application of vaccines in preventing incidence.
- Students will also be introduced to several techniques used routinely in the lab. This will include antibody isolation from human plasma which will then be used as a standard to measure the change in antibody titre over time in response to vaccination by ELISA.
- The structure, specificity and sensitivity of antibodies induced by vaccination will also be characterised by SDS-PAGE.
- Students will gain the understanding that good laboratory practice and precision in following protocols is essential for scientific research.

SSC Practical Research Description:

Neisseria Meningitidis is a species of gram-negative, diplococcus bacterium that causes pathology in the nervous and circulatory systems of humans. Of the 13 serogroups identified only a handful are responsible for the majority of disease throughout the world (A, B, C, Y and W). Infections can result in rapidly developing, life-threatening meningitis and meningococemia. Average bacterial carrier rates of *Neisseria meningitidis* are 10% throughout all ages, with this increasing to 25% in 15 to 19 years of age. Meningococcal vaccines are the most effective method in prevention of disease to date. Nimenrix is a quadravalent, polysaccharide, Tetanus Toxoid conjugated vaccine against *Neisseria* serogroups A, C, W and Y. The project aims to assess changes in antibody titre over time to Nimenrix vaccination by generating an antibody standard isolated from a bank of immune plasma.

Novel Biomarkers for Arthritis: Investigating the non-conventional externalisation pathway used by Transglutaminase 2 (TG2).

Institution: Dentistry

Department: Tissue Engineering and Reparative Dentistry

Tutor: Miss Rhiannon Griffiths

Project Code: PGR04

Brief Project Aims:

To investigate the role of pore formation by P2X7 receptors in the externalisation of TG2 and how amino acid changes within different regions of the receptor affect this release.

Educational Objectives:

- To understand the functions of TG2 and P2X7 receptors, specifically in the context of arthritis.
- Understanding how knowledge of the non-conventional method of externalisation of TG2 could apply to other proteins.
- Understanding of how single amino acid changes can change the structure and function of a protein and how mutations in specific proteins may affect a patient in diseases such as Arthritis.
- To gain a basic knowledge of the lab skills required for cell culture and Western blots, and interpretation of results.
- Presentation of a complex subject in a way that people with no prior knowledge can understand.

SSC Practical Research Description:

TG2 crosslinks proteins in the extracellular matrix, potentially altering their functions. It has been shown that there are increased levels of TG2 released from cells in Osteoarthritis. The pathway through which TG2 leaves the cells is unknown, but involves the pore forming capabilities of the P2X7 receptor. HEK293 cells stably transfected to express P2X7 receptor variants are transiently transfected with a TG2 expression plasmid to allow stimulation of the receptor and comparison of how much TG2 is released by Western blot. Group 1 will stimulate the cells with ATP (to allow formation of pores by the P2X7R) and collect and prepare media for analysis, as well as identifying activated cells using microscopy. Group 2 will begin a Western blot by further preparing the samples to allow loading and running of a reducing SDS-PAGE gel and transferring the protein onto a membrane. Group 3 will continue the Western blot, probing with primary and secondary antibodies and developing the Western blot to visualise the results.

Assessing the formation of osteoclasts from human peripheral blood mononuclear cells through the addition of stimulatory factors in vitro.

Institution: Infection & Immunity

Department: Rheumatology

Tutor: Miss Lauren Jordan

Project Code: PGR05

Brief Project Aims:

To establish a profile of osteoclast differentiation over a 21 day time-course.

Educational Objectives:

- The objective of this project is to obtain a clear understanding of the formation and functional activity of the osteoclast in bone homeostasis.
- Through practical experience students will acquire knowledge and first-hand experience of staining methods used to show the presence of osteoclasts in vitro, and learn the data analysis skills necessary to establish a profile of osteoclastogenesis.
- The data obtained shall then be discussed in a bench to bedside approach with respect to arthritis and similar bone diseases.

SSC Practical Research Description:

Ivory disks seeded with +ve monocytes shall be provided for students at the following time points; day 7, 14, 17 and 21. Students shall stain disks using two different staining protocols to highlight the presence of both mononuclear cells and osteoclasts. Images of the disks shall then be acquired by the students using microscopy, where images shall allow the following data collection; i.) mononuclear cell counts, ii.) pre-osteoclast counts, iii.) osteoclast counts. A profile of osteoclastogenesis over the 21 day time-course shall then be shown from the data collected.

Microbial adhesion to denture acrylic; the effects of adherence time and artificial saliva pre-conditioning on adherence of microbial cells, and viable cell recovery rate

Institution: School of Dentistry

Department: Tissue Engineering and Reparative Dentistry

Tutor: Mr Daniel Morse

Project Code: PGR06

Brief Project Aims:

To determine the effects of pre-conditioning denture material (poly(methyl methacrylate) [PMMA]) in artificial saliva and various adherence times on the adhesion of microbial cells and the number of viable cells recovered.

Educational Objectives:

- Develop knowledge of basic microbiology and biofilms (e.g. mechanisms of formation and roles of biofilms from a clinical and laboratory perspective).
- Understand the importance of microbial enumeration (e.g. role in diagnostics).
- Develop practical analytical microbiology skills such as bacterial/yeast enumeration and understand importance of aseptic technique.
- Develop good laboratory practice skills - in particular manual dexterity and prolonged concentration.
- Develop an understanding of the microbiology of biofilm formation and microbial growth in liquid culture and on agar plates.
- Use and development of time management skills and understanding of the importance of planning/preparation.
- Presentation skills.

SSC Practical Research Description:

12x samples; Pre-conditioned and non conditioned PMMA pieces. Two microorganisms; *Candida albicans*, *Streptococcus sanguinis*. Three adherence times (T); 0 minutes, 45 minutes, 90 minutes.

1. Microbial cultures grown overnight in liquid media, and sterile PMMA pieces pre-conditioned overnight in artificial saliva.
2. PMMA pieces aseptically added to 6 well plates and microbial cultures added to each piece.
3. At T0, duplicates of each sample are removed aseptically, rinsed to remove loosely adhered cells and placed into universals with diluent.
4. Vortex mix each universal for one minute to suspend cells.
5. Serial dilute samples and pipette onto agar.
6. At T45mins, and T90mins repeat steps 3-5.

7. Incubate plates overnight at 37°C, and count colonies when grown sufficiently.
8. Enumerate total recovered microbial cells for analysis. Count plates, analyse enumeration results to determine effect of artificial saliva pre-conditioning, and different adherence times.

Heart protein tango- interaction between cardiac myosin binding protein C and human ryanodine receptor.

Institution: WHRI

Department: IMEM

Tutor: Miss Paulina Stanczyk

Project Code: PGR07

Brief Project Aims:

Excitation-contraction (E-C) coupling is a fundamental process of muscle physiology by which electrically-evoked sarcoplasmic reticulum (SR) Ca²⁺ release triggers cardiomyocyte contraction. The type 2 ryanodine receptor (RyR2) is the major intracellular Ca²⁺ release channel localized on SR. It mediates the release of Ca²⁺ from the SR, triggering heart contraction. Cardiac myosin binding protein-C (cMyBP-C) is known to be a thick filament-associated protein involved in coordinating sarcomere contraction by affecting cardiac diastolic and systolic hemodynamics. This project aims to characterize biochemically a putative interaction between RyR2 and cMyBP-C, which could provide a novel retrograde regulation of SR Ca²⁺ release by the sarcomere. In particular, minimal interacting regions involved in RyR2:cMyBP-C binding will be assessed.

Educational Objectives:

- The student will face the stimulating challenge of correlating biological function of the cardiac muscle ryanodine receptor (RyR2) complex with the molecular interactions of heart contraction-associated protein (cMyBP-C).
- The project involves training in the acquisition and analysis of biochemical, biophysical and structural data.
- This should encourage the student to understand the methodology behind biomolecular interaction studies and also limitations of the used techniques.
- Further, the student will have the opportunity to exchange and discuss their knowledge and ideas with their colleagues, enhancing problem solving and presentation skills..

SSC Practical Research Description:

Cell culture- HEK293 line maintenance and passaging. Samples- 2 x 2 different samples (four in total) of the two recombinant proteins (one RyR2 c-Myc tagged fragment and one HA-tagged cMyBP-C) heterologously expressed in mammalian cells. Homogenization of cells- mechanical, using fine needle and glass beads with addition of complete protease inhibitors to preserve proteins; samples will be solubilized with 2% CHAPS. Co-immunoprecipitation assay- using rabbit polyclonal anti-haemagglutinin (HA) antibody (AB) or of Normal AB normal rabbit IgG. SDS-PAGE- four 12% gels will be used with β -mercaptoethanol as reducing agent. Semi-dry transfer system- to transfer proteins on PVDF membranes. Western blotting (WB) assay- using mouse monoclonal for c-Myc WB or mouse monoclonal

antibody for HA WB at appropriate dilutions. As secondary antibody, goat anti-mouse IgG horseradish peroxidase conjugated antibody will be used. Chemiluminescence assay- visualize protein-immunoreactive bands using ECL detection.

Assessing altered calcium signalling in failing cardiomyocytes

Institution: Institute of Molecular and Experimental Medicine (IMEM)

Department: Ionic Cell Signaling (ICS)

Tutor: Miss Alice Mitchell

Project Code: PGR08

Brief Project Aims:

Facts: Heart failure (HF) is a leading cause of morbidity and mortality worldwide. Normal heart function is dependent on highly controlled ion fluxes, in particular calcium (Ca²⁺) release which 'controls' contraction; and the bioavailability of adenosine triphosphate (ATP), the basic metabolic energy unit in cells. In HF there is perturbed Ca²⁺ signaling and a metabolic imbalance in cardiomyocytes. Aims: To prepare HL-1 cardiomyocyte monolayers for experiments. To drive a substrate of Ca²⁺ signaling perturbation using pharmacological tools (e.g. staurosporine). To analyse the extent of Ca²⁺ perturbation caused by the drug(s) used.

Educational Objectives:

- Understand the link between perturbed Ca²⁺ signalling and ATP imbalance.
- Improve understanding of scientific methodology.
- Aseptic techniques in cell culture.
- Using a confocal microscope.
- Improve data analysis skills.
- Presentation skills

SSC Practical Research Description:

Cell culture: splitting HL-1 cells, seeding coverslips with appropriate density for experiments. Prepare drug dilution series for incubating with cells. Confocal microscope imaging of Ca²⁺ oscillations. Analysis of data generated using specific software.

Ryanodine receptor and the origin of heartbeat

Institution: WHRI (MEDIC)

Department: IMEM

Tutor: Dr Saptarshi Mukherjee

Project Code: PGR09

Brief Project Aims:

Background facts: The human cardiac ryanodine receptor (hRyR2) is an intracellular ion channel that is responsible for the regulated release of Ca^{2+} from the sarcoplasmic reticulum (SR) stores in response to membrane depolarisation. The RyR is the largest known ion channel in man and one of the least understood due to lack of structural information. Once released, the Ca^{2+} ions act on the contractile proteins in the myocyte cytoplasm to bring about contraction. This phenomenon is known as Excitation-Contraction-Coupling (ECC) and forms the basis of normal cardiac function. Mutations occurring in the RyR2 gene gives rise to faulty ion channel proteins that cause abnormal Ca^{2+} release in ventricular myocytes leading to cardiac arrhythmia and also sudden cardiac death (SCD). Aims: We need to understand the exact molecular mechanisms by which the disease causing mutations cause channel instability leading to aberrant Ca^{2+} release in order to find therapeutic drug molecules that could stabilise the channel. We will first attempt to study the physiological nature of single human RyR2 channels at a molecular level using electrophysiological techniques that will provide a platform for future studies on the function of mutant channels.

Educational Objectives:

- Understanding the physiological role of Calcium-induced- Ca^{2+} release (CICR) in the process of excitation-contraction-coupling in the myocardium.
- Understanding of the fundamental nature of ion channel gating that provides a precisely regulated pathway for ions across membranes necessary for signal transduction.
- Using single channel electrophysiology to study the function of RyR2 when activated by cytosolic Ca^{2+} .
- Use of recombinant channel proteins expressed in a human immortal cell line.
- Single channel data analysis to describe the channel gating behaviour: use of concepts in statistics and probability theory.
- Presentation skills.

SSC Practical Research Description:

The RyR2 being an intracellular ion channel cannot be studied using conventional patch-clamp electrophysiological techniques (used for cell membrane ion channels). In our lab we have cloned the human RyR2 gene and transfected the gene into immortal Human embryonic kidney (HEK) cells that then transiently express the RyR2 channel protein at high levels. The channels are then isolated from the cells using solubilisation and ultracentrifugation techniques. The RyR2 channels are then 'reconstituted' back into artificial planar lipid bilayers to mimic the membrane. The channels close and open to let ionic

current flow through in response to Ca^{2+} and such currents are studied at the single molecule level using a sophisticated electronic set-up. Students will be shown how to record and analyse the single channel behaviour of hRyR2 to quantify channel activity. This technique is currently the only one that allows real-time functional study of single molecule dynamics of RyR2.

Potential Biomarkers for Cervical Disease in Young Women

Institution: Institute of Cancer and Genetics

Department: Department of Obstetrics and Gynaecology

Tutor: Miss Rachel Houghton

Project Code: PGR10

Brief Project Aims:

Facts: Human Papillomavirus (HPV) is the main cause of cervical cancer. In 2008 the HPV vaccine was introduced so it is important to look for novel methods of identifying women who are likely to develop cervical cancer in the vaccinated population. HPV gene disruption is one possible method currently being explored to act as a biomarker for cervical disease progression. Aims: To develop molecular lab skills and knowledge in areas such as DNA extraction, PCR, gel electrophoresis and gel interpretation. Analyze outcome of molecular testing and interpret results in association with anonymised clinical data from Cervical Screening Wales.

Educational Objectives:

- Understand biology of HPV, HPV vaccination, cervical screening and cervical cancer.
- Analyze data from molecular testing and link to clinical data to identify if gene disruption is a viable biomarker for disease progression.
- Discuss the pros and cons of different cervical cancer prevention strategies in a vaccinated population.
- Presentation skills.

SSC Practical Research Description:

Cervical screening has prevented many cases of cervical cancer by identifying women who have pre-cancerous disease (cervical intraepithelial neoplasia) and treating women before cervical cancer develops. The HPV vaccination programme will reduce levels of intraepithelial neoplasia, however the vaccine only protects against the most common HPV types. It is important to identify an optimal screening strategy for vaccinated women. At a molecular level the expression of the viral oncogenes, E6 and E7, is controlled by another gene, E2. This project assesses E2 gene disruption as a potential biomarker. Students will carry out molecular tests on a set of clinical samples, and then analyze their data along with other data from the lab to assess if E2 disruption is a suitable biomarker for identifying young women who are likely to develop cervical cancer, and make suggestions for other viable biomarkers.

The role of 'unconventional' antigen presenting cells in facilitating distinct immune responses – implications for cancer, autoimmunity and allergy

Institution: Infection and Immunity

Department: Innate Immunity and Critical Illness

Tutor: Mr Chris Tyler

Project Code: PGR11

Brief Project Aims:

Background: The type of immune response induced during an infection will differ depending on the pathogen involved; an anti-tumour/viral response will differ dramatically from an anti-bacterial/parasitic response. Antigen presenting cells (APCs) are a specialised subset of immune cells which 'decide' which immune response is necessary, and subsequently induce the appropriate response to combat the unique pathogen. However, APCs can be subverted in tumour, autoimmune and allergic scenarios to actually promote these disease states.

Project Aims: Investigate the role of a novel subset of immune cells – $\gamma\delta$ T cells – which exhibit a multitude of functions including antigen presentation and tumour cell lysis.

Determine what roles these cells play in facilitating immune responses, and their contribution in disease states such as cancer, autoimmunity, and allergy. Explore the potential of these cells to act as diagnostic markers/targets for novel immunotherapies.

Educational Objectives:

- Understanding of the different types of immune response, and how these are involved during disease scenarios.
- Identify different cell types/molecules involved in the various aspects of immunity.
- Hands-on experience of techniques used to study cells and molecules of the immune system.
- Enhance problem-solving techniques necessary for scientific research.
- Data analysis/presentation skills.

SSC Practical Research Description:

Students will gain valuable insight into how the complex human immune system is studied, with hands on experience in immune cell isolation and culture. Students will also have the opportunity to use flow cytometry – an invaluable technique in scientific research which allows analysis of the immune system at the single cellular level. We will explore how to set up robust immunological assays, and the implications of data generated to contribute to our understanding of the immune system in healthy and disease states. Specific features include: Immune cell isolation from whole blood of healthy human donors, Setup of assays to assess cell activation, proliferation, and cytokine production, Preparation and staining of cells using fluorochrome-bound antibodies, Analysis of stained cells at the single cell level using flow cytometry, Data analysis, Relating scientific findings to the 'big picture', with discussion about novel diagnostic/therapeutic tools.

How CD4 T cells fight Influenza

Institution: Infection and Immunity

Department: MEDIC

Tutor: Ms Andrea Schauenburg

Project Code: PGR12

Brief Project Aims:

CD4 T cells orchestrate the adaptive immune response and play a crucial role in fighting infection such as influenza. This project will demonstrate how CD4 T cells recognize and respond to virally infected cells.

Educational Objectives:

Students will learn about:

1. The main subsets of lymphocytes and their role in fighting infections.
2. Basic cell culturing techniques and cytokine release assay; data analysis.
3. Careful handling of human samples.

SSC Practical Research Description:

Students will stimulate lymphocytes purified from human blood with influenza derived peptides in order to simulate viral infection (group 1). They will then set up a cytokine release assay allowing quantification of signaling molecules released by CD4 T cells in response to "infected" cells (group 2). Data from this assay will be analyzed and discussed (group 3).

Examining the biological basis of deteriorating cognition in Huntington's disease.

Institution: Institute of Psychological Medicine and Clinical Neurosciences

Department: MRC Centre for Neuropsychiatric Genetics and Genomics

Tutor: Mr Jordan Scoberg-Evans

Project Code: PGR13

Brief Project Aims:

To investigate potential gene expression changes following learning, and whether such changes differ between control and Huntington's disease model animals.

Educational Objectives:

- Understanding of Huntington's disease symptomatology and pathology, mouse models of Huntington's disease, an understanding of behavioural tasks investigating learning, and knowledge of gene expression profiles.
- To identify learning-dependent changes in gene expression and whether any differences arise between control and Huntington's disease animals.
- Laboratory skills – performance of gene expression analysis from mRNA using real-time quantitative PCR – and data analysis.
- Presentation skills.

SSC Practical Research Description:

Huntington's disease (HD) is an autosomal dominant progressive neurological disease characterised by motor, cognitive, and psychiatric disturbances. Significant changes in gene expression have been reported in mouse models of HD, which are similar to transcriptional alterations seen in HD brain and correlate with deficits in motor, learning, and memory tasks. In a cohort of HD and control mice we conducted a series of learning tasks based on a well validated learning task to examine gene expression changes that may contribute to, or be dependent upon, learning. Gene expression profiles of HD and control mice will be analysed through the use of qPCR to investigate differences in expression levels of genes between trained and untrained animals.

Identifying Morphological changes in the aorta of murine models of Rheumatoid Arthritis

Institution: IMEM

Department: Cardiovascular Metabolism

Tutor: Miss Jessica Williams

Project Code: PGR14

Brief Project Aims:

To analyse changes in cell morphology in aortic rings from non immunized, mild and severe arthritis. Identify early morphological changes that preclude cardiovascular disease.

Educational Objectives:

- Gain an understanding of normal and diseased state of murine aorta.
- Understand the effect of systemic inflammation on cell morphology.
- Enhance knowledge and scientific methods including histology, immunohistochemistry and computational analysis.

SSC Practical Research Description:

Rheumatoid Arthritis now equals type 2 diabetes as a risk factor for cardiovascular disease. Vascular dysfunction has been previously linked with the endothelium. However, our model of collagen induced arthritis does not support these findings in early disease. The model links vascular dysfunction with an early increase in matrix metalloproteinase 9 (MMP-9). Increased levels of MMP-9 are deleterious to the vasculature by breaking down the extracellular matrix within the vessel walls. It is important to identify any early morphological changes, within the vasculature that may initiate cardiovascular pathology. This project will provide the opportunity to identify early changes to the vascular in mild arthritis in comparison to control animals and those with a severe form of arthritis.

How cells protect themselves against HIV-1 infection: the role of SAMHD-1.

Institution: Infection and Immunity

Department: Dermatology and Wound Healing

Tutor: Miss Magdalena Czubala

Project Code: PGR15

Brief Project Aims:

Evaluate and compare the role of SAMHD-1 restriction in HIV-1 infection in dendritic cells and Langerhans cells.

Educational Objectives:

- Students will gain a good understanding in meningococcal disease and the application of vaccines in preventing incidence.
- Students will also be introduced to several techniques used routinely in the lab. This will include antibody isolation from human plasma which will then be used as a standard to measure the change in antibody titre over time in response to vaccination by ELISA.
- The structure, specificity and sensitivity of antibodies induced by vaccination will also be characterised by SDS-PAGE.
- Students will gain the understanding that good laboratory practice and precision in following protocols is essential for scientific research.

SSC Practical Research Description:

Students will employ various laboratory techniques to differentiate and describe different types of cells isolated from human blood sample (cell culture, microscope, flow cytometry, FACS analysis). They will learn how to measure the levels of proteins of interest in our cells (cell lysing, western blotting). Using lentiviral particles, student will attempt to down regulate SAMHD-1 protein in cells, and see how this alteration affects HIV-1 infection of these cells (experiment setup, HIV-1 infection, cells transfection). Finally, student will have a chance to analyze and discuss collected data and present it in a form of graph and plots.

A randomised controlled trial to investigate the effect of meditation on mood and empathy.

Institution: Cochrane Institute of Primary Care and Public Health

Department:

Tutor: Dr Mariana Julieta Galante

Project Code: PGR16

Brief Project Aims:

To conduct a small randomised controlled trial. To perform a basic analysis of the results

Educational Objectives:

- To learn how a randomised controlled trial generally works and what its main advantages and limitations are.
- To understand the role of statistics in the context of randomised controlled trials.
- To learn how to describe samples and some basic skills (graphical and statistical) to compare them.
- To reflect on ethical aspects to be considered when setting up research studies in public health.
- To improve critical appraisal skills.

SSC Practical Research Description:

Some meditation techniques have shown positive effects on mood and empathy when compared against passive control groups. Students will design a small randomised controlled trial using other students as participants to compare a meditation technique against an active control group without a cognitive component. Intervention and control training sessions will consist of a 10-minute video (provided to students). Questionnaires will be used to measure three outcomes: pleasant emotions, unpleasant emotions and perspective taking. Each group of four students will measure one outcome. Data from the experimental session will be enriched with data from a real study for students to describe the sample and compare the arms of the trial. Finally, students will discuss the results integrating the three outcomes and will reflect on the strengths and limitations of the study.

The role of White Blood cells in particular CD8 T cells during viral infection

Institution: Infection and Immunity

Department: School of Medicine

Tutor: Mr Rebar Mohammed

Project Code: PGR17

Brief Project Aims:

Understand the role of White blood cells during infection in particular viral infection.

Educational Objectives:

- Animal house: dissecting mouse (C57BL/6) for tissue harvest. Student can watch how we dissect laboratory animals for organ collection and what we need for various researches.
- Cell purification. In this session students can purify CD8 T lymphocytes from spleen and/or lymph nodes using MACS column magnetic cell separation techniques based on bead conjugated antibodies.
- In vitro activated CD8 T lymphocyte re-stimulation using relevant peptide and checking the amount of cytokine secretion between re-stimulated and non-stimulated cells using flow cytometry.

SSC Practical Research Description:

White blood cells, particularly CD8 T lymphocytes play a pivotal role in viral infections. The ability of CD8 T cell to secrete various amounts of cytotoxic cytokines and mediators is considered essential to clear viral infection. This can be examined by purifying CD8 T cells from mice spleen and/or lymph nodes, which are considered as main sources of CD8 T lymphocytes in the body, and challenging them in vitro with influenza virus derived Nucleoprotein (NP68) pulsed with irradiated Antigen presenting cells (APC). As the cells activate and differentiate to generate effector CD8 T cells, the amount of cytotoxic cytokines and chemical mediators can be measured upon re-stimulation with the relevant peptide by using flow cytometric assay.