Vacation Scholarships May 2012

In total, 22 applications were received and 18 Vacation Scholarships were awarded for short research projects as indicated below.

Gillian Scott (Neuroscience, Dundee University) supervised by Dr Sheriar Hormuzdi, for a project entitled: **Are Electrical Synapses Plastic? Studies in a Novel Transgenic**

Electrical synapses are special pores that span neurons enabling them to communicate rapidly. Despite the fact that they are widespread and serve as an alternative – to that mediated by the more common receptor-based mechanisms – mode of electrical signal propagation in the brain, they are poorly studied. This project will determine if their presence and density varies during brain development and changes when neurons are engaged. The studies will utilize a unique animal model that enables microscopic observation of electrical synapses and will provide the basic knowledge necessary to reveal their importance for the normal and pathologic brain.

Vojtech Prazak (Microbiology, Aberdeen University) supervised by Dr Samantha Miller for a project entitled: **Investigating the lipid-protein interactions of the YnaI mechanosensitive channel**

Channels are specialised molecules which are essential for all cells to grow. The mechanosensitive channels are found in all kingdoms of life, involved in pain, touch, hearing, balance. In bacterial cells they are required for cells to survive water stress and thus are a potential new target for antimicrobial therapies. We have developed a number of tools and techniques which allow us to investigate how the mechanosensitive channels function. This project will use modern molecular and genetic techniques to identify regions of the channels essential for their function and thus inform our ultimate goal to provide novel strategies to combat bacterial infections.

Sana Rintala (Immunology, Glasgow University) supervised by Dr Carl Goodyear, for a project entitled: **Evaluation of the osteoclasotgenic mechanisms that are altered by immunomodulation**

Bone ersoion is a feature of many diseases including rheumatoid arthritis, osteoporosis and multiple myeloma. The bone-eating cells (osteoclasts) responsible for this process, and the cells that they mature from, are found in greater numbers in the diseased condition. Strategies that can target this aspect of the disease process are of intense interest. We have recently found a therapeutic that can manipulate this process through the regulation of the cellular pathways that control the fate of the precursors of osteoclasts. The proposed study will examine this mechanisms underlying this regulation.

Hayley Patterson (Immunology, Glasgow University) supervised by Professor Iain McInnes, for a project entitled: **Is syk kinase implicated in psoriasis and psoriatic arthritis pathogenesis?**

There is much interest in finding new targets for the treatment of arthritis and skin diseases that are caused by inflammation. Recently a new class of drugs entitled kinase inhibitors have been developed that have been very effective in clinical trials in the treatment of rheumatoid arthritis. In particular a medicine called fostamatinib has been shown to be effective in treating rheumatoid arthritis – this drug targets a particular molecule called syk kinase. We will explore the presence and function of syk kinase in tissues derived from patients with psoriasis and psoriatic arthritis to establish whether this might also be a valid target for application in these diseases in due course.

Emma Batchen (Medical Sciences, Edinburgh University) supervised by Dr Fiach O'Mahoney,for a project entitled: **High throughput analysis of renal cell carcinoma using automated quantitative analysis for the discovery of prognostic and predictive protein biomarkers**

The incidence of renal cell carcinoma (RCC) (8th most common cancer in the UK) is increasing and outcomes remain poor. There are currently no molecular tests available to predict which patients who have undergone 'curative' surgery will relapse and who will respond to therapy. Proteomic approaches such as automated quantitative analysis (AQUA), which quantifies protein expression using fluorescently tagged antibodies, yield information about deregulated biochemical pathways involved. The ultimate aim of the study would be to identify markers that can be used to predict therapeutic response and be readily applied to the clinic as predictive molecular tests.

Kunza Jamal (Biochemistry, Glasgow University) supervised by Dr Daniel Walker, for a project entitled: **Production and characterisation of novel pyocins active against *Pseudomonas aeruginosa***

Colonisation of the lungs of patients with cystic fibrosis by the bacterium *Pseudomonas aeruginosa* is the main cause of mortality associated with this condition. The natural resistance of this pathogen to many commonly-used antibiotics can make *P. aeruginosa* infections very difficult to treat in some patients and there is an urgent need to develop new therapies. The aim of this project is to produce and test the ability of protein antibiotics to kill *P. aeruginosa* clinical isolates. The ultimate goal of this work is to develop these protein antibiotics as novel therapeutics for the treatment of *P. aeruginosa* infection.

Anna Price (Statistics, Glasgow University) supervised by Dr Jackie Price at Edinburgh University, for a project entitled: **Plasma N-terminal pro B-type natriuretic peptide (NT-proBNP) as a marker of cardiovascular risk in people with type 2 diabetes**

Plasma N-terminal pro B-type natriuretic peptide (NT-proBNP) is a peptide produced by the ventricles of the heart in response to cardiac stress. It has been shown to be a marker of increased risk of developing clinically-important heart disease in individuals from the general population. However, we do not know if NT-proBNP is also a predictor of heart disease and/or related conditions in people with type 2 diabetes, a group of people who are particularly prone to developing heart disease. This project will investigate the links between NT-proBNP and heart disease in people with type 2 diabetes, to determine whether or not the peptide could be useful in clinical practice to identify a particularly high-risk group of individuals who would benefit from enhanced preventive measures.

Rebecca Crook (Medicine, Dundee University) supervised by Dr Jenni Harvey, for a project entitled: **Targeting the estrogen system to treat CNS-driven disease**

Numerous clinical studies indicate that cognitive impairments are prevelant in women following the menopause. Reduced levels of the hormone estrogen are linked to these impairments and recent studies indicate that estrogen markedly influences learning and memory. Thus estrogen-based therpaies may be useful in treating cognitive decline in women. However our understanding of how estrogen influences brain function is limited. Here we propose to examine the impact of different estrogen receptors on glutamate receptor trafficking: a key event underlying learning and memory.

Heather Horsburgh (Forensic Biology, Napier University) supervised by Dr Kevin Smith, for a project entitled: **Matrix metalloproteinase 9 as a biomarker for breast cancer onset and metastasis**

Many proteins in the body have sugar chains attached which ensure that the protein is able to "work" properly but can also be altered uniquely in disease. Matrix metalloproteinase 9 (MMP-9) is a type of protein called an enzyme which increases in amount in breast cancer. This project will look at the sugar chains attached to MMP-9 in breast cancer and see if any changes can be linked to the onset and spread (metastasis) of breast cancer. There is currently no serum biomarker for breast cancer, therefore this research could result in the development of a test for the disease.

Ross Henderson (Medicine, Edinburgh University) supervised by Dr Rebecca Reynolds, for a project entitled: **Investigating depressive symptoms in obese pregnancy: identifying risk factors, influences on gestational weight gain and birthweight, and exploring underlying mechanisms**

Depression in mothers during pregnancy is common and is potentially devastating, affecting the wellbeing of both mother and baby. Obese women are at high risk of depression and, alarmingly, one in five Scottish pregnant women is obese. We plan to assess rates of depressive symptoms in severely obese and normal-weight pregnant women. We will identify any additional risk factors for depression, determine any adverse consequences for mother and baby, and explore one potential underlying mechanism, namely altered maternal stress hormone levels. Ultimately we hope to be able to identify those women most at need of intervention to prevent this major health problem.

Holly Morrison (Immunology, Glasgow University) supervised by Professor Gerard Graham, for a project entitled: **Examining the functional importance of CCR10 upregulation on neutrophils by TLR ligands**

White blood cells remove bacteria and viruses from our bodies by moving to the point of infection and killing the infectious agent. White blood cell movement is controlled by 'chemokines' made at infected sites and white blood cells possess 'receptors' allowing them to detect and move towards the chemokines at the sites of infection. Interestingly, when white blood cells detect the infectious agents, they change the receptors they express. This allows them to move to other body sites. We do not fully understand this process and this project will examine the importance of these changes for fighting infections.

Katrina Wallen (Neuroscience, Aberdeen University) supervised by Dr Peter Teismann, for a project entitled: **Can licorice extract provide protection against Parkinson's disease?**

Parkinson's disease is a common neurodegenerative disorder affecting more than 10,000 people each year in the UK. Major symptoms as tremor, muscle stiffness, and paucity of voluntary movements, are due to the loss of specific brain cells necessary for normal motor function and it remains unknown why these neurons die and lead finally to Parkinson's disease. We want to establish how we can protect these brain cells and thus prevent Parkinson's disease using a component from licorice, which has been shown to be capable of protecting cells and the possible pathways involved.

Karen Crokston (Microbiology, Glasgow University) supervised by Dr Andrew Roe, for a project entitled: **Characterising the interaction of drug target mutants with host cells**

We have previously found a group of drugs that interfere with how bacteria attach and infect human cells. However, working out how these drugs work is difficult. One step forward has been to find out what the targets of these drugs are. In this study we would like to see what happens to bacteria when we specifically remove one of these drug targets and will see if the bacteria can still infect human cells. This is an important step forward in understanding how these drugs work, which is essential if we want to make them even more potent. The long-term aim is to make a new class of anti-infective compounds to use clinically.

Paul Middleton (Medicine, Dundee University) supervised by Dr Graham Rena, for a project entitled: **The guanidine group as a mitochondrial tag and its implications on drug function**

Research on the chemical composition of biguanide antihyperglycaemics (metformin) and the similar diguanide compounds has suggested that an integral chemical group within these drugs (guanidine) directs these drugs to the mitochondria and is therefore a major component of their function. This project aims to prove that the guanidine group can selectively target molecules to the mitochondria and then assess the implications of the addition of this compound on existing pharmaceuticals and novel compounds.

Linn Olsen (Psychology, Glasgow University) supervised by Dr Stephanie Rossit of Glasgow Caledonian University, for a project entitled: **Studying relationships between eye movement deficits and lesion locations in stroke patients**

Every year an estimated 150,000 people suffer from a stroke in the UK. One of the most common deficits observed after stroke is left neglect, a condition in which patients behave as if the left side of the world ceased to exist. In this project we will characterize eye movement behaviour in stroke patients with left neglect and localize which brain regions when damaged are associated with eye movement deficits in stroke patients. This work will broaden our understanding of the deficits present in neglect patients and may help develop new techniques for diagnosis and rehabilitation.

Chee Limm (Genetics, Edinburgh University) supervised by Professor Andrew Rambaut, for a project entitled: **System for the evolutionary and epidemiological characterization of newly isolated influenza strains**

Influenza virus is responsible for tens of thousands of death worldwide annually. The virus undergoes rapid evolution that allows it to repeatedly evade our existing immunity. It is crucial to track and understand the changes in influenza virus circulating globally. New variant strains are regularly isolated and sequenced but evolutionary analysis is largely done on an *ad hoc* basis. We propose to create a prototype software system that can regularly collate newly sequenced virus sequences and automatically perform evolutionary analyses in the context of previously circulating strains. This will ultimately also help inform policy on surveillance and control of influenza.

Bartlomiej Kulka (Biochemistry, Glasgow University) supervised by Dr Brian Smith, for a project entitled: **Do the endotoxin binding domains of Factor C cooperate in endotoxin binding?**

An extract of Horseshoe Crab blood is widely used by the pharmaceutical industry to ensure sterility of medical equipment and even drugs that are injected in humans. However, the basic mechanism underlying this powerful test has not been fully investigated. The project aims to understand how a protein from the Horseshoe Crab blood recognises bacteria. The results might help to design synthetic agents that recognise and neutralise bacterial contaminants inside a human body that could improve the detection and treatment of conditions such as toxic shock and Lyme's disease.

Amanda Trimble (Veterinary Medicine, Glasgow University) supervised by Dr John Marshall, for a project entitled: **Analysis of peritoneal fluid serum amyloid A (SAA) to predict survival in equine colic**

Acute phase proteins (APPs) are used in human and veterinary medicine to aid in the diagnosis and monitoring of diseases including gastrointestinal conditions. In the horse, gastrointestinal disease (colic) is the most common cause of death following old age. This study will investigate APPs in samples of blood and peritoneal fluid from horses suffering from colic. By measuring APPs in horses, we will investigate if it is possible to predict the type of disease, the need for surgical intervention, and the risk of death. By establishing a clinically relevant and accessible method of measuring APPs in the horse this study will benefit equine welfare and veterinary medicine.