School of Medicine

Research projects and information for prospective students 2016

Honours, Masters and PHD

CRICOS Provider Code: 00113B

School of Medicine Faculty of Health
Geelong Waurn Ponds, Locked Bag 20000, Geelong, VIC 3220
Tel 03 5227 5740 john.stambas@deakin.edu.au www.deakin.edu.au

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An overview of the Honours program H413

The Honours program in the School of Medicine is designed to build upon the skills and knowledge obtained from the completion of a three year undergraduate degree. The program aims to provide students with the opportunity to pursue an independent investigative research project in the areas of health and medicine along with relevant course work. This will enable students to expand their depth of knowledge in their chosen research area and provide a suitable qualification for entry into a higher degree by research program (Masters or PhD).

The School of Medicine program is a Type A Honours Degree, leading to award of a Bachelor of Health and Medical Sciences (Honours) (course code H413). This program, which comprises both coursework units and a research thesis, is undertaken over one year full-time. Each student is allocated a primary research supervisor and in some circumstances a co-supervisor.

Entry requirements

Applicants must have completed an accredited undergraduate degree in the broad area of health and medical science (of at least three years length) in a discipline related to the area of their research project. Applicants will require a mid-credit (>65%) average for the third year or equivalent of undergraduate study to be eligible for selection.*

Bachelor of Medicine Bachelor of Surgery (H311) students who do not meet the above requirement and wish to apply will require a minimum GAMSAT score of 60 and have successfully completed a minimum of 8 credit points of the Bachelor of Medicine Bachelor of Surgery course. Entry into H413 for Bachelor of Medicine Bachelor of Surgery (H311) students will be available at the end of the first, second or third year of the course and will be a competitive process.

*Entry will also be determined by the availability of supervisors and resources.

Course Structure of H413

The course comprises three Units, worth a total of eight credit points to be taken over one year of full-time study. The requirements include: an independent research project/thesis worth four credit points conducted under the supervision of the nominated supervisor for that project, a two credit point unit in research methods, and a two credit point unit in developing research skills in health and medical sciences. The course will be structured in the following way:

HMH401: Developing Research Skills	2 credit points (Trimester 1)
HBS400: Research Methods	2 credit points (Trimester 1)
HMH402: Honours Research Project	4 credit points (Trimester 2)

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HMH401: This Unit will provide you with a thorough understanding of your research field through the generation of a research proposal whilst at the same time helping you to develop skills essential to research, including online literature searching, presentation skills and critical analysis of literature. Assessment involves the development of a research proposal, the completion of a literature review and an oral presentation of the research findings prior to submission of the thesis.

HBS400: This is a Faculty-wide Unit comprised of a series of modules, in which the students must complete a required number of modules. Students select modules that are the most relevant to their project and in areas in which they require support. All modules are completed and assessed in Trimester 1.

HMH402: This Unit involves the implementation of the research project. While the enrolment is in Trimester 2, students will actually commence their research project in Trimester 1. The assessment for this Unit is writing up the research in a thesis format that includes a literature review, research methodologies, research results and a discussion of the findings. The literature review (which is undertaken as part of HMH401) will be only assessed in relation to the relevance to the project and the hypothesis and aims.

- Developing Research Skills Trimester 1 2 credit points
- Research Methods Trimester 1 2 credit points
- Research Project/Thesis Trimester 2 4 credit points

The Honours year is an exciting year because it provides the first real opportunity to get a feel for research and students develop a wide range of research and problem-solving skills. However, students should be aware that this year is a challenging and demanding year, involving at least 35 hours per week of study and/or research work.

Honours Scholarships

Commencing Honours students are eligible to apply for merit-based Scholarships to the value of $1,000 and $2,000. Individual supervisors may offer additional funding.

Contact details

For further information please contact the Honours Course Director:

Assoc Prof John Stambas
Phone: (03)5227 5740
Email: john.stambas@deakin.edu.au

Applying for Honours

To apply for Honours in the School of Medicine please follow the steps below:

1. Select a research project

Examine the list of research projects that the school is offering for 2016. For those projects that you are interested in, you must personally contact the named supervisor to discuss the proposed project. The

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supervisors contact details are provided together with the project description. This will enable you to gauge whether the research project aligns with your career goals, and enables the supervisor to establish whether you have the appropriate academic background to undertake and complete the research project.

2. Complete the project preference form

This form is provided in this booklet. Either hand in to the School of Medicine reception staff, or alternatively email somset@deakin.edu.au or post to Student Experience Team (School of Medicine, Deakin University, Locked Bag 20000 Geelong, Vic. 3220) by **November 13, 2015.** This form MUST be filled out so that projects can be allocated to students based on the criteria outlined below.

3. Submit an on-line application

All prospective honours students MUST also apply directly to Deakin University. Submit an online application at http://applicantportal.deakin.edu.au/connect/webconnect. Closing dates for applications is **November 13, 2015**.

- You will need to register as a user in order to apply. Select the 'Register' link to activate a username and password to gain entry to the online application. NOTE: Current Deakin students – your Deakin username and password will not gain you access to the online application.
- Complete all of the questions on the online application. NOTE: Referee details are not required
- Complete the final step ONLY if your undergraduate studies were NOT undertaken at Deakin University. This final step requires applicants to upload scanned and certified copies of their University academic transcript(s).

4. Project allocation

Students will be allocated a project based on a combination of student preferences, supervisor's student preferences and a mid-credit (>65%) average for the 3rd year or equivalent of undergraduate study. Successful candidates will be advised of their offer during end Nov-early Dec 2015.

The projects on offer within the School of Medicine reflect the expertise and research that is currently undertaken by the prospective supervisors at Deakin and at our affiliate institutes. It must be noted that due to the nature of research, the focus and direction of a research group may change over time and the final project may not necessarily be exactly as described.

Please refer to the website for any further information on Honours in the School of Medicine: http://www.deakin.edu.au/medicine/research/research-projects .

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2016 Honours Project Preference Form

Your name: _____

Address: _____

_____Postcode_____

Contact Phone Number: _____

Email: _____Deakin student ID: _____

Applicants are advised that allocation to research projects is a competitive process and an applicant cannot be assured of being assigned to their choice of research projects.

Please nominate below three preferences, in order, for an Honours project (and supervisor) for 2016 from the list of projects on offer.

1st preference - Project number: _____

Project title: _____

Supervisor: _____

Have you personally spoken with the supervisor about the project? Yes ☐ No ☐

2nd preference - Project number: _____

Project title: _____

Supervisor: _____
Have you personally spoken with the supervisor about the project? Yes ☐ No ☐

3rd preference - Project number: _____

Project title: _____

Supervisor: _____
Have you personally spoken with the supervisor about the project? Yes ☐ No ☐

If you are NOT offered one of the above projects would you consider an offer of an Honours project in a related area? Yes ☐ No ☐

Please hand this form in to the School of Medicine reception staff, or alternatively email somset@deakin.edu.au or post to Student Experience Team (School of Medicine, Deakin University, Locked Bag 20000, Geelong, Vic 3220) by November 13, 2015 for timely applications. In some circumstances and by approval of the course director, late applications may be considered depending on availability of appropriate supervisors, projects and places up until January 31, 2016.

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Doctor of Philosophy and Master by Research

The key to entry (besides meeting entry qualifications) into a PhD or Masters by Research program is the support of a School of Medicine staff member to supervise you. It is essential, therefore, that you discuss your application for one of the listed projects with the relevant supervisor(s) prior to applying. Note the application form requires an applicant to provide a one page outline of their proposed research program.

Applying

Applications for candidature are accepted at **any time**; however for applicants seeking scholarships please note the appropriate closing dates shown below. With the support of a supervisor, submit an application.

The application and scholarship process for Australian and New Zealand Citizens and Australian Permanent Residents can be found at: http://www.deakin.edu.au/future-students/research/how-to-apply.php and http://www.deakin.edu.au/future-students/research/scholarships/apa-dupr-scholarship-information.php. Applications for scholarships close at the end of **October** each year.

The application and scholarship process for International applicants can be found at: www.deakin.edu.au/internationalisation/hdr. Applications for scholarships from International students close at the end of **July** each year.

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Cancer

1. The case for plain tobacco packaging in the Pacific

Supervisor/s: Erik Martin, Colin Bell

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Tobacco use is among the leading causes of preventable death in the Pacific Islands and globally. Pacific Health Ministers have set the target of lowering tobacco use prevalence in the Pacific to 5% by 2025. Success will require adopting cost-effective and innovative tobacco control provisions such as plain packaging, which Australia introduced in a world-first. Thus far, no Pacific Island countries have attempted to introduce plain packaging.

The aim of this research project is to explore the barriers and facilitators to developing and implementing plain packaging policy in Pacific Island countries.

The methodological approach will firstly include a literature review investigating tobacco control and plain packaging activities amongst Pacific Island countries. This will include the investigation of both peer-reviewed and grey literature (i.e. news articles, websites of relevant organisations and reports). Secondly, primary qualitative data will be collected in the form of in-depth telephone (or Skype) interviews with approximately 5-15 key government stakeholders in tobacco control from selected Pacific Island countries.

The significance of this research is that firstly, ascertaining the barriers and facilitators to plain-packaging - a model that has proven successful in Australia - will foster more knowledge on how to implement it effectively and thereby exploit its positive affect on non-communicable diseases. Secondly, to the knowledge of the researchers there is no current research on plain packaging in the Pacific Islands, so little is known on whether or not governments are seeking to implement this measure and what their understandings may be. Finally, it may help Pacific Health Ministers meet their ambitious target of reducing tobacco prevalence to 5%.

Contact supervisor:
Dr. Erik Martin (Deakin Medical School): erik.martin@deakin.edu.au (03)5227 1432

Suitable for: Honours

This project is subject to final approvals.

2. Identifying the therapeutic role of specific histone deacetylase inhibitors in paediatric tumours

Supervisor/s: Jason Hodge, Rasika Samarasinghe, Andrea Muscat, David Ashley

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Epigenetic regulation is controlled by different types of modification some of which include DNA methylation, histone acetylation and ubiquitination. Unlike DNA mutations, altering the epigenetic profile holds great potential for cancer therapy as modifications in cells are reversible and can occur pre- or post-transcription. Modification of histones are of particular interest as they show significant effects on tumour differentiation, inhibition of cancer cell growth and in the induction of cell cycle arrest. Histone acetylation is a reversible mechanism and is regulated by the activity of the enzymes histone deacetylases (HDACs). Deacetylation by HDACs leads to a more closed chromatin structure thus repressing gene expression of tumour suppressor genes. HDAC inhibitors (HDACi), a new class of anticancer drugs, have the potential to stimulate histone acetylation, enabling the expression of cancer inhibitory genes. Several classes of HDACs are reported and several pan-HDAC inhibitors targeting a wide range of these HDACs are currently used clinically. However, these pan-HDACi cause unwanted off-target side effects leading to the discontinuation of these drugs. Identifying HDACi that target specific HDACs upregulated in cancer holds great therapeutic potential primarily as it may minimize off-target effects.

The aim of this study is to investigate the potential differentiative and/or apoptotic actions of novel specific HDACi, available pre-clinically, in tumourigenic cell lines derived from several paediatric solid tumours, including rhabdoid tumour, neuroblastoma and osteosarcoma. Together, these three tumours represent the most resistant of childhood cancers to current therapies and are the most devastating with regard to morbidity and mortality. The hypothesis of this study is that these targeted HDACi will induce terminal differentiation and irreversible senescence in tumourigenic cells, with potential results warranting further investigation in in vivo models.

Contact supervisor:
Dr. Jason Hodge (Barwon Health): jason.hodge@deakin.edu.au (03)5227 1174

Suitable for: Honours

3. Understanding the metabolic role of histone deacetylase inhibitors in paediatric solid tumours

Supervisor/s: Jason Hodge, Rasika Samarasinghe, Sean McGee, David Ashley

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Heritable changes in gene expression that do not involve changes in DNA sequence are defined as epigenetics. One common mechanism of epigenetic regulation involves reversible histone acetylation. Cleavage of acetyl groups by histone deacetylases leads to a more condensed form of chromatin and gene silencing. Histone deacetylase inhibitors (HDACi) are a new class of anticancer drugs that cause changes in acetylation status leading to alterations in gene expression, induction of apoptosis, cell cycle arrest, and inhibition of angiogenesis and metastasis in tumourigenic cells and solid tumours.

We have found that pan-HDACi together with chemotherapeutic drugs play a major inhibitory role in the growth of paediatric solid cancers such as rhabdoid tumours. However, the metabolic activity regulated by these HDACi in cancer cells remain to be elucidated. The aim of this study is to investigate the potential metabolic alterations induced by HDACi on several paediatric tumorigenic cell lines. In addition, the use of an inducible expression system in rhabdoid tumours will be utilised to further evaluate the metabolic regulatory role of epigenetic modifiers. The hypothesis of this study is that novel HDACi inhibit cancer cell growth by reverting glycolytic cancer cells to a normal oxidative state thus inducing cell differentiation and senescence.

Contact supervisor:
Dr. Jason Hodge (Barwon Health): jason.hodge@deakin.edu.au (03)5227 1174

Suitable for: Honours

4. Evaluating the therapeutic use of IDH mutant inhibitors in the treatment of glioma

Supervisor/s: Jason Hodge, Rasika Samarasinghe, David Ashley

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Brain tumours (specifically gliomas) are uncommon tumours but have devastating effects on patients' lives and the lives of their caregivers. Although gliomas make up only two percent of all cancers (approximately 2,000 new diagnoses per year in Australia) they result in the fourth highest loss of potential years of life (12 years). Despite being the focus of consistent research attention, gliomas remain incurable with existing treatment modalities, namely: surgery, radiation therapy and chemotherapy.

Several important genetic alterations in gliomas have been known for some time but the advent of new technologies have led to a number of novel discoveries in the last few years, the most significant of which was the finding that a high percentage of low-grade gliomas (and a lower percentage of higher grade gliomas) contain mutations in genes encoding isocitrate dehydrogenase (IDH) 1 and 2, which are major enzymes of the TCA cycle.

As cancer cells display dysfunctional metabolic activity, the aim of this study is to evaluate the ability of two novel drugs that specifically target mutant IDH1 and IDH 2 to be able to restore this altered metabolism. The hypothesis of this study is that inhibition of IDH mutant proteins in glioma will return cells to a normal oxidative phenotype and render them susceptible to targeting by existing cancer therapies.

Contact supervisor:
Dr. Jason Hodge (Barwon Health): jason.hodge@deakin.edu.au (03)5227 1174

Suitable for: Honours or PhD

5. In vivo chemical screen in zebrafish to identify novel therapeutics and solvents

Supervisor/s: Yann Gibert, Luke Henderson, Prusoth Yogananthara

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Identification of novel solvents and therapeutics in vivo is one of the highest priorities of pharmaceuticals companies today. This project will develop capability and capacity for fast-tracking therapeutic molecules, combining experts in Synthetic Organic Chemistry, Molecular Modelling, Enzymology, Cell Biology, and Whole Animal Analysis during zebrafish embryogenesis. Using these it will be possible to attain convincing chemical and biological efficacy data to leverage funds for ongoing studies through commercial partners or through nationally competitive grants. Recently, we have reported the development of small molecules as highly active and selective antitubercular agents and anti-prostate cancer agents which will serve as the starting point for this study. Moreover this study will test the use of novel solvent in vivo for the pharmaceutical industry. This project will mainly focus on the detection of the induce apoptosis by these chemical compounds exposure during zebrafish embryogenesis.

Contact supervisor:
Dr. Yann Gibert (Deakin Medical School): y.gibert@deakin.edu.au (03)5227 1197

Suitable for: Honours or PhD

6. Fat, muscle and cancer

Supervisor/s: Julie Pasco, Sharon Brennan-Olsen, Lana Williams, Kara Holloway

Location: Barwon Health, Geelong

Project description:
This project is designed to explore the relationship between the amount and distribution of fat and muscle tissue in the body, and the risk of cancer. Detailed body composition data for men and women enrolled in the Geelong Osteoporosis Study will be linked with the Victorian cancer registry. While there are extant data that obesity increases cancer risk, research to-date has relied on anthropometric measures such as the body mass index (BMI, calculated from weight and height) or waist and hip circumferences. In this project the candidate will use dual energy x-ray absorptiometry (DXA) data, that has been measured by trained personnel, to more accurately assess body fat distribution and also determine total and appendicular muscle mass. This novel project will inform a growing awareness of a role for metabolically active tissue in the aetiology of cancer. Importantly, body composition may become recognised as a modifiable risk factor for cancer, and a potential target for prevention. The project will add to a growing evidence base for informing public health messages for the primary prevention of cancer.

The candidate will work closely with the research team at the Epi-Centre for Healthy Ageing, in the Innovations in Mental and Physical Health and Clinical Trials Strategic Research Centre (IMPACT SRC), situated at Barwon Health. The project will foster an appreciation of epidemiological study design, data linkage and statistical analysis.

Contact supervisor:
Prof. Julie Pasco (Barwon Health): juliep@barwonhealth.org.au (03)4215 3331

Suitable for: Honours or PhD

7. Interventions & impact on cancer population in last 90 days of life

Supervisor/s: Peter Martin, David Ashley, Vanessa Vaughan, Paul Lewandowski

Location: Barwon Health, Geelong

Project description:
There is increasing literature to suggest that burdensome interventions are too frequent in the last 30, 60 and 90 days of life for patients with advanced cancer. This is despite the increasing use of validated prognostic tools and a greater policy direction to empower patients to be cared for and die in a place of their preference. Most studies suggest most people wish to spend more time at home during this phase of their illness. In addition there is increasing literature that a high proportion of limited health resources are utilized in the last 6 months of life. There is minimal data about this in the Australian context.

This study will investigate a range of interventions and resource utilization in the last 30, 60 & 90 days of life. This will include referral patterns to palliative care services, use of disease modifying therapy, admissions to acute, sub-acute and residential aged care facilities. In addition it will capture specific interventions such admission to intensive care units, "MET" and "code blue" calls among others. As well as patient and carer demographics this will explore the impact of time spent at home and place of death. In a proportion of this population it should be possible to obtain symptom inventory scores and QOL measures as a measure of disease burden from the clinical information systems present in the region.

Data analysis will look at patient and disease characteristics that influence service models / processes that result in minimizing unwanted burdensome interventions and facilitate care in the patient / carers' place of preference.

Contact supervisor:
Assoc. Prof. Peter Martin (Barwon Health): peter.martin@deakin.edu.au (03)4215 5565

Suitable for: Honours or PhD

8. Monitoring lifestyle of patients with cancer cachexia via a Smart Phone App

Supervisor/s: Vanessa Vaughan, Peter Martin, Paul Lewandowski

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
An estimated 50% of cancer patients develop skeletal muscle cachexia (wasting), suffering a significant loss of up to 30% of their original body weight. In addition when cancer patients develop cachexia they also have a decreased chance of survival and often must stop curative cancer therapies. Although cancer cachexia is highly prevalent, to date there is no cure or very few therapies that can slow or prevent the development of the condition. Despite the prevalence of cancer cachexia, most patients with the condition live in a community setting (not hospital) and normally only receive clinical support every 4 - 6 weeks. This mode of managing patients with cachexia means that data relating to their lifestyle is collected infrequently and relies on patients remembering behaviours in-between clinical visits.

This project will provide students with the opportunity participate in a pilot study based in Geelong and selected palliative care clinics in Western Victoria that shall test the suitability of using a Smart Phone App to collect lifestyle and clinical data in cachexia patients residing in the community. Specifically this study will attempt to answer the research question of whether it is possible to use a smartphone App to collect data from patients with cachexia between their routine clinical visits. Students undertaking the project would be expected to travel throughout the Geelong region and selected Victorian Western District towns with a member(s) of their supervisory team. Students will also be expected to analyse additional data collected by Barwon Health Community Palliative Care nurses. Thus the final data mix would be one of information collected first hand along with data collected as part of a much larger collaborative project.

Contact supervisor:
Dr. Vanessa Vaughan (Deakin Medical School): v.vaughan@deakin.edu.au (03)5551 8533

Suitable for: PhD

9. Monitoring of physical activity of patients with cancer cachexia in a community setting

Supervisor/s: Paul Lewandowski, Peter Martin, Vanessa Vaughan

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
An estimated 50% of cancer patients develop skeletal muscle cachexia (wasting), suffering a significant loss of up to 30% of their original body weight. In addition when cancer patients develop cachexia they also have a decreased chance of survival and often must stop curative cancer therapies. Despite the prevalence of cancer cachexia, to date there is no cure or very few therapies that can slow or prevent the development of the condition. Despite the prevalence of cancer cachexia, most patients with the condition live in a community setting (not hospital) and normally only receive clinical support every 4 - 6 weeks. This mode of managing patients with cachexia means that data relating to their lifestyle is collected infrequently and relies on patients remembering behaviours in-between clinical visits.

This project will provide students with the opportunity to participate in a pilot study that shall test the suitability of using 'off the shelf' activity monitoring devices e.g. Fitbit, in patients with cachexia. Students will be required to travel with the supervisors of the project to collect data in the Geelong region along with analysing additional data that has been collected by community palliative care nurses from the same region. Data collected will be used to predict if a patients status has declined between clinic visits and be used to initiate earlier clinical intervention(s).

Contact supervisor:
Assoc. Prof. Paul Lewandowski (Deakin Medical School): paul.lewandowski@deakin.edu.au (03)5227 1111

Suitable for: Honours or PhD

10. Novel treatments of cancer cachexia

Supervisor/s: Paul Lewandowski, Vanessa Vaughan

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
An estimated 50% of cancer patients develop skeletal muscle cachexia (wasting), suffering a significant loss of up to 30% of their original body weight. Interestingly, research has shown that weight loss associated with cancer cachexia is not accounted for by a decrease in dietary intake, but rather a specific inflammatory catabolic response. In addition when cancer patients develop cachexia they also have a decreased chance of survival and often must stop curative cancer therapies. Despite the prevalence of cancer cachexia, to date there is no cure or very few therapies that can slow or prevent the development of the condition.

This project will provide students with the opportunity to learn cell culture skills along with those needed to design and complete rapid in vitro screening of novel compounds including dietary fatty acids formulated in unique combinations, that may be of use to prevent or treat cancer cachexia. In addition the project also incorporates Gene expression analysis, Protein electrophoresis & Immunoblotting, Biochemical analysis, Enzymatic analysis and Histological analysis.

Contact supervisor:
Assoc. Prof. Paul Lewandowski (Deakin Medical School): paul.lewandowski@deakin.edu.au (03)5227 1111

Suitable for: Honours or PhD

11. The role of free radicals in the development of cancer cachexia

Supervisor/s: Paul Lewandowski, Melanie Sullivan-Gunn

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
An estimated 50% of cancer patients develop skeletal muscle cachexia (wasting), suffering a significant loss of up to 30% of their original body weight. In addition when cancer patients develop cachexia they also have a decreased chance of survival. Interestingly, research has shown that weight loss associated with cancer cachexia is not accounted for by a decrease in dietary intake, but rather a specific inflammatory catabolic response. Free radicals have been suggested to contribute to progressive tissue damage in other diseases of heart muscle, kidney, spinal cord, vascular smooth muscle and skeletal muscle, but to date the role of free radicals in the development of cancer cachexia has not been studied.

This project will provide students with the opportunity to learn animal surgical techniques, cell culture and skills needed to run a dietary trial. In addition the project also incorporates Gene expression analysis, Protein electrophoresis & Immunoblotting, Biochemical analysis, Enzymatic analysis and Histological Analysis.

Contact supervisor:
Assoc. Prof. Paul Lewandowski (Deakin Medical School): paul.lewandowski@deakin.edu.au (03)5227 1111

Suitable for: Honours or PhD

This project is subject to final approvals.

12. Aptamer-engineered gold nanoparticles for targeted cancer treatment

Supervisor/s: Wei Duan, Phuong Tran

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Development of effective nanoparticles in cancer therapy is beyond ordinary use of the delivery of either therapeutic drugs or imaging agents. By utilizing the inherent properties of imaging agents, multifunctional nanoparticles can simultaneously image and treat cancer specifically targeted to tumour sites. Gold nanoparticle is a promising candidate due to a huge number of advantages such as nanoscale, ease of preparation, good compatibility, easy modification to impart various functionalities without altering the biological activity of the conjugate species, function in an alternate anticancer therapy, for instance, photothermal therapy where gold nanoparticles can absorb light and can be used to heat and ablate tumours. The nanoparticles which have favourable tumour penetration and become biologically aggregated within tumours result in absorbance amplification and preferential hyperthermia when exposed to Near Infrared region. Tumours then by low pH environment and proteolysis act as catalysts induce an aggregation of the nanoparticles and increase NIR absorption and resultant heating, leading to their own destruction. A development of aptamer-mediated gold nanoparticles conjugated with anticancer drugs for tumour targeted precision drug delivery is a promising approach for all-inclusive function of therapeutics and tumour observation in fighting against cancer with increased treatment efficacy and reduced toxicity.

The student will:

- develop or characterize aptamers against cancer stem cell surface markers;
- synthesize and functionalize gold nanoparticles; and/or
- enhance the therapeutic index of anticancer drugs; and/or
- investigate mechanisms underlying targeted gold nanoparticles in increasing activity of drugs and reducing chemoresistance of the cells.

Contact supervisor:
Prof. Wei Duan (Deakin Medical School): W.Duan@deakin.edu.au (03)5227 1149

Suitable for: Honours or PhD

13. Development of aptamer-based nanomedicine to overcome chemoresistance in solid cancers

Supervisor/s: Wei Duan, Phuong Tran

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The project will develop novel nanoparticle-based agent for effectively target cancer stem cells. It aims to address two major causes underlying treatment failure of chemotherapy, inability to deliver an adequate therapeutic dose to the site(s) of the cancer and inability to target tumourigenic/chemoresistant cells. With the support from a team of researchers, the honours student will develop or characterize new aptamers, also known as chemical antibody, against cancer stem cell surface markers. By conjugating chemotherapy and other DNA intercalating drugs to the specially engineered stem of aptamers, the student(s) aims to improve the treatment efficacy and at the same time to reduce the toxicity of these drugs. The student will explore novel approaches to develop: 1) aptamer-conjugated chemotherapy drugs that remain conjugated with the aptamer at neutral pH but was released swiftly below pH 6.0 after endocytosis; or 2) upon binding, the drug-aptamer was efficiently endocytosed (in contrast to the random diffusion of the free drug); or 3) enhanced penetration into the tumour core while minimising exposure of normal tissues. Through this project, the student will attempt to establish an aptamer targeted delivery that endows new pharmacodynamics to these traditional anti-cancer drugs: eliminating tumourigenic/cancer initiating cells and overcoming chemoresistance. The overall goal is to transform a first-line chemotherapy drug into a novel therapy with increased treatment efficacy and reduced toxicity.

The techniques involved in these projects include: UV-VIS spectroscopy, high-performance liquid chromatography, mammalian cell culture, transfection, synthesis and characterize of nucleic acid aptamers, cell viability assay, determination of IC50 (a measure of the effectiveness of a substance in inhibiting a specific biological or biochemical function), tumour sphere assay, laser scanning confocal microscopy, flow cytometry and molecular imaging.

Contact supervisor:
Prof. Wei Duan (Deakin Medical School): W.Duan@deakin.edu.au (03)5227 1149

Suitable for: Honours or PhD

14. Ripping the guts out of ovarian cancer

Supervisor/s: Sarah Shigdar, Justin Henri

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Ovarian cancer is one of the most lethal cancers amongst any gynaecological malignancy. Despite prolific drug development, the survival rate of ovarian cancer has remained relatively stagnant since 2008, with five year survival rates of around 43%. This is due to a lack of adequate early diagnostic tests, leading to diagnosis at a late, advanced stage, with widely metastatic disease, where chemotherapeutic options are limited. It has been postulated that a targeted therapeutic strategy would be more effective, while reducing the side effects associated with current therapies. We have been successful in developing chemical antibodies against two cancer stem cell markers, and will be adding to our repertoire in an attempt to eradicate cancer. These chemical antibodies, known as aptamers, are developed in the laboratory by a process known as SELEX, and can be directly linked to drugs, nanoparticles or radioisotopes. These smart bombs can target the tumourous tissues with high affinity and specificity, while leaving healthy tissue intact, thus minimising the toxic side effects of conventional treatment. This project aims to develop a novel smart targeted therapeutic capable of delivering drugs to EpCAM-positive ovarian cancer cells, and will generate a novel therapeutic using conventional chemotherapeutics that have been shown to have efficacy but are limited by their toxic side effects. Additionally, the EpCAM-positive population of ovarian cancer drug resistant cells possess drug efflux pumps on their cell surface which actively pump out drugs that enter the cell via simple diffusion mechanisms. Having developed an aptamer targeted to EpCAM expressed on the highly tumourigenic and therapy resistant tumour cells, this project will develop this aptamer into an effective cytotoxic agent capable of taking out this subpopulation of cells.

This project will use flow cytometry, confocal microscopy, molecular biology techniques and cell culture.

Contact supervisor:
Dr. Sarah Shigdar (Deakin Medical School): sarah.shigdar@deakin.edu.au (03)5227 2846

Suitable for: Honours or PhD

15. Disruption of cytokine signalling in cancer

Supervisor/s: Alister Ward, Clifford Liongue

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Cell-cell signaling represents an integral function of multicellular organisms. One such signalling system is based on a network of cytokines. These proteins bind to specific cytokine receptors on the surface of target cells and transmit signals rapidly to the nucleus via the so-called Janus Kinase/Signal Transducer and Activator of Transcription (Jak/Stat) signalling pathway, to mediate appropriate changes in gene transcription. Dysregulation of cytokine signaling through the Jak/Stat pathway is a hallmark of leukaemias, lymphomas and other blood cell diseases.

We have pioneered the use of zebrafish as an experimental model to study cytokine signalling, particularly with regard to the development of blood and immune cells. The aim of this Project is to investigate how disruption of cytokine signalling contributes to blood and immune cancers.

This Project will utilise a range of cellular and molecular approaches utilising zebrafish knockout and transgenic lines to investigate specific components of the cytokine signalling pathway.

Contact supervisor:
Prof. Alister Ward (Deakin Medical School): award@deakin.edu.au (03)522 72041

Suitable for: Honours or PhD

Immunity

16. Understanding the role of CISH in influenza virus immunity

Supervisor/s: John Stambas, Siying Ye, Alister Ward

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
The impact of influenza virus infection is an ongoing major public health concern. Significant morbidity and mortality is associated with infection, especially in susceptible populations such as the very young and elderly. In has been suggested that each year, influenza virus infection in Australia results in approximately 310,000 general practitioner consultations, 18,400 hospitalisations and a 115 million dollar burden to the Australian healthcare system. Understanding the mechanisms that drive immunity and protection from virus infection is critical for the development of novel intervention strategies to improve epidemic and pandemic preparedness. Importantly genome-wide association studies have identified single nucleotide polymorphisms (SNPs) in the human CISH (cytokine-inducible SH2-containing protein) gene associated with increased susceptibility to a number of infectious agents, including malaria, invasive bacteria and certain viruses. CISH is a member of the suppressor of cytokine signalling (SOCS) family of negative regulators. It is induced by a number of important haematopoietic cytokines, including erythropoietin and various interleukins, and subsequently inhibits their signalling in vitro. However, understanding of the in vivo function of CISH remains limited, especially following virus infection. Utilising a newly-developed Cish knockout mouse and the well characterised influenza mouse model we aim to determine the role of CISH following influenza virus infection.

Contact supervisor:
Assoc. Prof. John Stambas (Deakin Medical School): john.stambas@deakin.edu.au (03)5227 5740

Suitable for: Honours or PhD

This project is subject to final approvals.

17. The role ADAMTS proteoglycanases in influenza virus immunity

Supervisor/s: John Stambas, Siying Ye

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
The emergence of pandemic swine-origin H1N1 influenza virus in 2009 and the more recent H7N9 outbreaks in China have highlighted the ongoing and unpredictable threat influenza viruses pose to human health. Improving current therapeutic strategies is critical to ensure adequate protection for future pandemics. Recent in vitro and in vivo influenza virus studies have identified novel host genes involved in influenza virus immunity. A number of these genes encode for extracellular matrix remodelling enzymes called "ADAMTS". The ADAMTS family contains 19 members, 7 of which can cleave proteoglycans (extracellular matrix structural proteins) and are termed proteoglycanases. This project will utilise cell culture and ADAMTS knockout mouse models to characterise the role ADAMTS enzymes play in influenza virus infection with a goal of developing novel therapeutics to ameliorate disease.

Techniques to be used: molecular biology, tissue culture, flow cytometry, virology, immunohistochemistry, immunology.

Contact supervisor:
Assoc. Prof. John Stambas (Deakin Medical School): john.stambas@deakin.edu.au (03)5227 5740

Suitable for: Honours or PhD

School of Medicine Faculty of Health
Geelong Waurn Ponds, Locked Bag, 20000, VIC 3220
Tel 03 5227 5740 john.stambas@deakin.edu.au www.deakin.edu.au

18. Is the pigeon crop the avian mammary gland?

Supervisor/s: Tamsyn Crowley, Anthony Keyburn

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Avian mammary gland? Birds don't lactate, or do they? Over the last few years we have been investigating an intriguing biological phenomenon present in a select group of birds, namely the production of crop milk in pigeons. Crop milk, also known as 'pigeon milk', is a nutrient substance produced by both male and female pigeons to feed their young. As with mammalian milk, crop milk is essential for squab growth, providing both nutritional and immune benefits. During the process of pigeon 'lactation', a curd-like substance is regurgitated from the crop to the squab. Crop milk is predominately made up of protein and fat with a small amount of carbohydrate. High levels of morbidity or mortality was observed when pigeon squabs were fed with artificial crop milk suggesting there is a unique factor or factors present in pigeon milk required for squab growth and development. It has been shown that pigeon milk contains IgA antibodies, providing further evidence to suggest that it is more than just a nutrient based substance. Conversely, in a 1952 study where pigeon milk was fed to chickens, their rate of growth improved by 38%. We have since replicated this study and found that the GI tract of chickens fed pigeon milk were colonized with Veillonella, a pre-biotic bacteria found in pigeon milk, that has also been shown in humans to be shared between the maternal and neonatal gut ecosystem via breastfeeding. Our group has also begun investigating the main proteins in pigeon milk, with a particular interest in the evolution of these proteins. We are interested to see if there is any cross over with proteins in the milk of both platypus and echidna, since this special group of marsupials both lay eggs and suckle their young. To date we have gained a great deal of knowledge and insight into this magnificent biological phenomenon and we will continue to explore if the pigeon crop is indeed the avian mammary gland. This project will investigate the major proteins produced in pigeon milk using proteome analysis. In addition, the proteome generated in this project will be bioinformatically correlated with previous transcriptome data that our laboratory has generated.

Contact supervisor:
Dr. Tamsyn Crowley (Deakin Medical School): Tamsyn.Crowley@deakin.edu.au (03)5227 1328

Suitable for: Honours or PhD

19. The early life microbiome, innate immune development and asthma

Supervisor/s: Peter Vuillermin

Location: Barwon Health, Geelong

Project description:
In animal models the maternal and infant gut microbiome has been shown to profoundly influence immune development, and in turn, the risk of immune related disease. Data from human studies are lacking. The Barwon Infants Study (BIS, www.barwoninfantstudy.org.au) is an NHMRC funded population-derived birth cohort study (n=1074) that has incorporated the assembly an internationally unique array of biological samples and detailed phenotyping of range of physiological and clinical outcomes including food allergy, asthma, neurodevelopment and markers of atherosclerotic heart disease. We have recently established that infants at risk of food allergy have a hyper-responsive innate immune signature at birth. Moreover, this immune signature appears to be modified by epidemiological markers of microbial experience. For example, pet ownership is associated with attenuated innate immune responses and a substantially reduced risk of food allergy. We believe this pathway may also be relevant to wheezing disorders such as asthma, which have been characterised in unique detail among the BIS cohort. The successful applicant will participate in the 4y BIS participant reviews - taking a key role in the ensuring the quality of the respiratory phenotyping. They will then work with the BIS team, and our collaborators from the Human Microbiome Project to prosecute a world class investigation of the relationship between the early life human microbiome, immune development and childhood asthma.

Contact supervisor:
Assoc. Prof. Peter Vuillermin (Deakin Medical School): peter.vuillermin@deakin.edu.au 0400071218

Suitable for: PhD

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

20. The relationship between the microbiome and early markers of cardiovascular disease risk

Supervisor/s: Peter Vuillermin

Location: Barwon Health, Geelong

Project description:
Cardiovascular disease (CVD) is a major source of morbidity and mortality and novel paradigms are required to inform prevention strategies. Although the majority of CVD research and prevention activity targets adults, CVD has its origins in early life. There is intense interest in the potential relationship between early life gut microbiome and atherosclerosis, the inflammatory process that underlies CVD. The gut contains 10 times as many bacteria as there are cells in the human body. The composition and activity of the gut microbiome is influenced by modifiable factors such as mode of birth, microbial exposure, antibiotics and diet. In turn, the gut microbiome has a profound impact on immune development and function. The Barwon Infants Study (BIS, www.barwoninfantstudy.org.au) is an NHMRC funded population-derived birth cohort study (n=1074) that has incorporated the assembly an internationally unique array of biological samples and measures of early markers of CVD risk. We have recently shown that maternal vaginal colonisation with Group B Streptoccus in the third trimester of pregnancy is strongly associated with the infants aortic intima media thickness in the first months of life. This association is seen only among infants delivered vaginally, suggesting infant inoculation with the maternal microbiome is likely to be of relevance. The proposed PhD program will involve an investigation of the relationship between the various potential environmental determinants of the infant gut microbiome and markers at CVD risk measured at 4 years of age. The successful applicant will participate in the 4y BIS participant reviews - taking a key role in the ensuring the quality of the CVD risk phenotyping. They will then work with the BIS team, and our collaborators from the Human Microbiome Project (JCVI) to prosecute a world class investigation of the relationship between the early life human microbiome and the development of markers of CVD risk in preschool aged children.

Contact supervisor:
Assoc. Prof. Peter Vuillermin (Deakin Medical School): peter.vuillermin@deakin.edu.au 0400071218

Suitable for: PhD

This project is subject to final approvals.

21. Shutting the gate on malaria parasites

Supervisor/s: Tania de Koning-Ward, Kathryn Matthews

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The Plasmodium parasites that cause malaria are one of the most successful pathogens to infect mankind. By exporting hundreds of their proteins into red blood cells, malaria parasites are able to drastically modify their host cell, enabling the parasite to replicate and cause disease while at the same time avoiding destruction by the human host. Our research group has made a major breakthrough in the malaria field by finding the parasites Achilles' heel - its uses a single gateway for the passage of parasite proteins into the host cell. Thus finding strategies to shut the PTEX gate will block the export of hundreds of proteins involved in parasite virulence and survival from accessing the host red blood cell, resulting in parasite death.

In order for the PTEX gate to export proteins, it needs to be synthesized and secreted at the right time so that it can be correctly assembled at the parasite-host cell interface to form the gate between the two. The aim of this project is to unravel how this occurs by utilizing the latest molecular approaches to create transgenic parasites that express mutated or truncated forms of the components that make up the PTEX gate fused to green fluorescence protein. This will enable the sequences that mediate correct PTEX trafficking to be identified by live cell imaging, with assembly of the PTEX gate monitored by immunoprecipitation and western blotting.

The project will provide the student with a very broad skills base including molecular biology techniques (eg. PCR, cloning, sequencing, southern blotting and reverse genetics), cell culture (eg. parasite culturing, transfection), protein techniques (Western blotting, immunoprecipitation) and cell biology techniques (immunofluorescence assays, live cell imaging using super resolution microscopy). Understanding how PTEX is assembled will help in identifying strategies that could be targeted with drugs to permanently shut the gate on malaria parasites.

Contact supervisor:
Assoc. Prof. Tania de Koning-Ward (Deakin Medical School): taniad@deakin.edu.au (03)5227 2923

Suitable for: Honours or PhD

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

22. Role of Prolactin receptor signaling through Jak2/Stat5 in development

Supervisor/s: Clifford Liongue, Alister Ward

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The correct development and maintenance of multi-cellular organisms is supported by systems enabling cells to communicate to one another in response to distinct cues. Cytokines are polypeptides that are produced and secreted by cells following a variety of stimuli, and induce a range of cellular effects via specific cytokine receptors located on the cell surface. These receptors signal to the nucleus via the so-called Janus Kinase/Signal Transducer and Activator of Transcription (Jak/Stat) signalling pathway to mediate effects on gene transcription and cell physiology. One of these, the Prolactin receptor, signals via Jak2 and Stat5 to mediate mammopoiesis and lactogenesis in mammals. Several other potential roles have been suggested for this pathway, but these require further investigation.

This Project aims to further our understanding of the developmental roles of the Prolactin receptor/Jak2/Stat5 pathway at the molecular level, as well as elucidating how changes in this pathway might lead to disease. It utilises zebrafish as a relevant model for the study of vertebrate development, including cytokine receptor signalling.

This Project will use zebrafish to investigate the role of one or more components of the Prolactin receptor/Jak2/Stat5 pathway using genome editing approaches and subsequent phenotypic and biochemical analyses.

Contact supervisor:
Dr. Clifford Liongue (Deakin Medical School): c.liongue@deakin.edu.au (03)5227 3071

Suitable for: Honours or PhD

23. Control of early blood and immune cell development: role of Ikaros transcription factors

Supervisor/s: Alister Ward, Parisa Rasighaemi

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Members of the Ikaros family of zinc finger transcription factors are important for immune system development, via their effects on key genes involved in this process. Perturbation of these transcription factors can lead to various diseases, particularly lymphomas and leukemias. However, relatively little is known about the most divergent member of this family, Pegasus, which retains a more ancient function compared to the other Ikaros members.

Recent studies in the laboratory have identified reciprocal antagonistic interactions between Pegasus and Ikaros, which may be very important in disease. The aim of this Project is to further investigate the molecular details by expression and purification of recombinant zinc fingers for analysis of DNA binding and protein-protein interaction, and co-expression of Pegasus and Ikaros in cell lines to investigate functional interactions.

This Project will use a range of biochemical and cell biological approaches, including tissue culture, transfection, immunohistochemistry, immunoprecipitation, Western blot analysis, recombinant protein production and various in vitro binding assays.

Contact supervisor:
Prof. Alister Ward (Deakin Medical School): award@deakin.edu.au (03)5227 2041

Suitable for: Honours or PhD

24. Identification of novel therapeutic agents using zebrafish

Supervisor/s: Alister Ward, Yann Gibert

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Zebrafish has been extensively used as an accessible vertebrate model for the study of development and the underlying genetic and molecular mechanisms involved in this process. However, this organism is increasingly being utilised to generate models of disease that can be applied to the identification of chemical agents able to ameliorate the disease phenotypes.

The aim of this Project is to use zebrafish transgenic and knockout models to identify pharmaceutical agents capable of affecting the development of specific cell lineages and/or disrupting the development of disease. This research will serve as an essential prelude to further pre-clinical studies of those molecules that elicit a significant effect on key developmental processes.

This Project will employ a range of cellular, molecular and chemical biology approaches utilising zebrafish as model for development and its disruption in disease. These will include screening of a library of chemicals in transgenic and knockout zebrafish lines.

Contact supervisor:
Prof. Alister Ward (Deakin Medical School): award@deakin.edu.au (03)522 72041

Suitable for: Honours or PhD

25. Keeping a lid on it: control of cell-cell signaling by the CISH protein

Supervisor/s: Alister Ward

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The CISH (cytokine inducible SH2-containing) protein was the first identified member of the Suppressor of Cytokine Signaling (Socs) family of proteins. This group of proteins act as key negative feedback regulators of cell-cell signaling, particularly through cytokine receptors that utilise the so called Janus kinase/Signal transducer and activator of transcription (Jak/Stat) pathway. CISH has been implicated in blood and immune system development in humans, mice and zebrafish. However, we believe that CISH acts as a broader physiological regulator via its negative regulation of several different cytokine receptors.

This Project will take advantage of a unique CISH knockout mouse line we have generated. These mice will be studied to examine the consequences of the loss of CISH on normal physiology and metabolism.

This Project will use mice as an experimental model to investigate the role of CISH, using sophisticated and extensive phenotypic, cellular and biochemical analyses to provide new insights into cytokine regulation.

Contact supervisor:
Prof. Alister Ward (Deakin Medical School): award@deakin.edu.au (03)5227 2041

Suitable for: Honours or PhD

26. The negative regulation of cytokine signalling during zebrafish development

Supervisor/s: Alister Ward, Clifford Liongue

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The proper development of multi-cellular organisms requires systems that enable cells to communicate with each other. Signaling molecules, including cytokines, are chemicals produced by cells that act to transmit information between them. These molecules interact with target receptors located on the cell surface to induce a wide range of cellular effects. This is mediated via the so-called Janus Kinase/Signal Transducer and Activator of Transcription (Jak/Stat) signaling pathway, mediating changes in gene transcription and cell function. It is essential however that signaling can be negatively regulated, otherwise cell functions such as proliferation and migration can become uncontrolled, leading to devastating outcomes. Specific proteins called SH2-containing tyrosine phosphatases (SHPs) serve as a 'brake' to negatively regulate signaling through the Jak/Stat and other signalling pathways.

SHP proteins have been found to be important in blood and immune cell development, with disruption of this pathway associated with diseases including inflammation and cancer. This Project will directly investigate the role of SHPs in early development.

This Project will employ a range of cell and molecular biology approaches utilising zebrafish as developmental model. These will include bioinformatics, gene expression analysis, gene knockout, as well as detailed functional and phenotypic analysis.

Contact supervisor:
Prof. Alister Ward (Deakin Medical School): award@deakin.edu.au (03)5227 2041

Suitable for: Honours or PhD

27. Natural killer cells in zebrafish immunity

Supervisor/s: Alister Ward, Clifford Liongue

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Innate immunity is an integral component of host defence against a variety of insults, including infection and cancer. This is mediated by a variety of white blood cells, including a heterogeneous population of natural killer (NK) cells. Therefore, the generation, maintenance and function of NK cells is vital to maintain health and combat pathogens.

Zebrafish represents a powerful experimental model for understanding development and disease, which we and others have used to better understand the immune system and its control. This Project will utilise zebrafish to characterise and explore the development and function of NK cells to gain further insight into their contribution to innate immunity.

This Project will employ a range of cell and molecular biology approaches utilising zebrafish as developmental model. These will include gene expression analysis using whole mount in situ hybridisation and RT-PCR, knockout and transgenic approaches, along with detailed functional and phenotypic analysis.

Contact supervisor:
Prof. Alister Ward (Deakin Medical School): award@deakin.edu.au (03)5227 2041

Suitable for: Honours or PhD

Infection

28. Engineering biological functions in vitro for vaccine development

Supervisor/s: Luis Malaver-Ortega, Alister Ward, Andrew Bean

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
Disease outbreaks are a constant threat to human population, especially today when the speed of the spread of new diseases is increased by our highly interconnected world. The major goals of vaccines are to improve health and prevent the transmission of disease. Moreover, often vaccines are the only way to offer population wide protection. Nevertheless, the current technology to produce vaccines can be considered as somewhat outdated and in a pandemic there will be an urgent need to have the capacity to supply large numbers of vaccine doses within a short period of time. New tools in molecular biology allow a wide range of gene editing and modification of the eukaryotic genomes. These new techniques offer the potential to modify various characteristics in the cell for multiple purposes. This project aims to create new cell lines and characterize their potential for industrial application in the vaccine industry, using state-of-the-art technology in cell and molecular biology and immunological techniques developed in the laboratory. A wide range of techniques, restricted to PC2, will be utilized in this project, including: precision genomic engineering, cloning PCR, virus culture, recombinant DNA, immunostaining, cell characterization, quantitative real time PCR, luciferase-reporter assays, histological techniques, cytometry, cell culture of pluripotent stem cells and germ cells and in vitro differentiation of pluripotent cells.

Contact supervisor:
Dr. Luis Malaver-Ortega (CSIRO-AAHL): Luis.Malaver@csiro.au (03)5227 5243

Suitable for: Honours

29. Investigating the proviral mechanisms of microRNAs that promote the replication of zoonotic viruses

Supervisor/s: Chwan Hong Foo, Cameron Stewart, Andrew Bean, Alister Ward

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
Emerging infectious diseases, such as H5N1 influenza, are a growing significant threat to mankind, especially those with a high mortality rate. Containment of ongoing and future outbreaks will benefit immensely from the development of novel broad-spectrum antivirals which can treat infections caused by a diversity of viruses. The generation of such therapieS depends on our understanding of how viruses replicate and the host molecules which are required for viral replication.

Viruses from different families, though genotypically distinct, do rely on certain common host pathways and molecules, such as microRNAs, for replication. MicroRNAs are small non-coding RNAs expressed by host cells that regulate gene expression. Results generated by our research group indicate that certain microRNA families can promote the replication of viruses from different families, including the orthomyxovirus influenza virus and the paramyxoviruses Hendra and Nipah virus. This suggests that inhibitors which block these microRNAs may be developed as broad-spectrum antiviral therapeutics.

This project aims to investigate the molecular mechanism(s) by which these proviral microRNAs regulate replication of highly pathogenic viruses such as H5N1 influenza virus. Computational bioinformatics will be used to predict candidate host genes which might be targeted by the proviral microRNAs. Quantitative real time PCR and luciferase-reporter assays will then be applied to identify the host genes which are actually downregulated by the microRNAs, and the antiviral impact of the genes will be tested using a number of techniques, such as gene overexpression and siRNA-mediated knockdown. The functional relationships between the antiviral genes and viral replication processes will also be studied, utilizing various cell and molecular biology approaches.

Honours students will not perform the experimental steps which require PC3/PC4 containment. These steps will be performed by trained CSIRO staff.

Contact supervisor:
Dr. Chwan Hong Foo (CSIRO-AAHL): chwan.foo@csiro.au (03)5227 5380

Suitable for: Honours or PhD

30. Development of novel anti-viral therapeutics

Supervisor/s: Christopher Cowled, Cameron Stewart, Alister Ward, Andrew Bean

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
Highly pathogenic viruses, such as avian influenza, have an alarming capability to infect humans and pose a continuous risk for poultry and fatal human infections. Attempts to avoid or contain outbreaks have been largely unsuccessful and this may be directly linked to our lack of fundamental knowledge about host-pathogen interaction. Therefore, it is essential to increase our knowledge of avian influenza virus infections to develop new approaches to dealing with this virus. This project aims to investigate various aspects of virus-host interaction for the development of new therapeutic strategies.

This project would appeal to a student interested in both bioinformatics and molecular immunology. The first part of the project will involve the use of high-throughput RNA sequencing (RNA-Seq) to measure the mRNA expression level of all protein-coding genes in the host during the course of virus infection. Once the data have been collected, bioinformatics methods will be used to identify genes potentially affecting virus replication. The second part of this project will be to investigate the role of several of these genes in vitro, using molecular immunology and classical virology techniques. Genes shown to influence virus replication will be evaluated.

There is no live PC3 or PC4 pathogen work required for this project.

Contact supervisor:
Dr. Christopher Cowled (CSIRO-AAHL): chris.cowled@csiro.au (03)5227 5026

Suitable for: Honours or PhD

This project is subject to final approvals.

31. Development of microRNA-based early detection technology for emerging infectious diseases

Supervisor/s: Chwan Hong Foo, Cameron Stewart, Andrew Bean, Alister Ward

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
Emerging infectious diseases, such as Hendra and Ebola, are a growing significant threat to mankind. The best of currently available diagnostic technologies are only able to detect viral infections just prior to the onset of symptoms. This makes it very challenging for public health authorities to detect and contain infectious diseases with long asymptomatic incubation periods, which can spread globally undetected and rapidly via modern air travel. Thus, the development of novel detection technologies that can identify infections early during the asymptomatic phase is critical, and will revolutionise the way we contain epidemics.

Preliminary data collected by our research group suggest that host microRNAs from biofluids may be an early biomarker for acute viral infections during the asymptomatic stage. This project aims to investigate changes in host biomolecule profiles in response to emerging infectious diseases, like Hendra and influenza, with the goal of developing a novel diagnostic tool. This project utilizes a number of different techniques, ranging from quantitative real time PCR, next-generation sequencing, proteomic assays, and luciferase-reporter assays. Host molecule expression will be studied in a number of animal models, including horses and ferrets. To elucidate the functions of principally important host molecules, various cell and molecular biology approaches will be used.

Honours students will not perform the experimental steps which require PC3/PC4 containment. These steps will be performed by trained CSIRO staff.

Contact supervisor:
Dr. Chwan Hong Foo (CSIRO-AAHL): chwan.foo@csiro.au (03)5227 5380

Suitable for: Honours or PhD

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

32. Dissecting the early steps of HIV infection

Supervisor/s: Johnson Mak, Megan Garvey

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
The envelope of HIV arguably is the only relevant target for the development of HIV vaccine. It is now appreciated that some of the crucial epitopes in envelope that can elicit broadly neutralization are often protected in multiple steps of virus infection process. Advancement of imaging technology in recent time has allowed us to visualize the movement of viral components, which has enriched our understanding on the interplay between virus and host during infection. We have recently observed that HIV has undergone significant rearrangement prior to entry. The objective of this project is to use fluorescent and electron microscopy technology to unravel the process of HIV-1 infection at the early stage of viral infection for the identification of novel property for vaccine design.

This project utilizes a combination of virology, molecular biology, tissue culture and cell biology approaches. The candidate will be taught to handle HIV, and to produce novel fluorescent-labeled HIV. Confocal Microscopy and Electron Microscopy (such as Cryo-EM and Scanning EM) will be employed for these analyses.

There is no live PC3 or PC4 pathogen work required for this project.

Contact supervisor:
Prof. Johnson Mak (Deakin Medical School): johnson.mak@deakin.edu.au 0439562574

Suitable for: Honours or PhD

33. Computational modeling of HIV assembly

Supervisor/s: Johnson Mak, Michael Kuiper

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
HIV assembly is a highly orchestrated process where viral precursor proteins join together in a highly specific manner. It is estimated that there are between 2500 and 5000 HIV Gag precursor proteins are needed to form a single viral particles. These precursor proteins are then cleaved by viral protease to generate mature proteins, where the mature proteins are then reassemble to generate infectious HIV. A process is conceptually similar to 'The robotic transformation of Transformers animation series'. Mutagenesis studies have shown that a subtle interference of this maturation process will block HIV infectivity. X-ray crystallography and cryo-electron microscopy studies have generated a large amount of structural data to describe this process, yet non-structural biologist oriented scientists often not readily appreciate these structural data. The objective of this proposal is to use gaming tools, such as virtual reality, to recreate the virus maturation process in silico. We will also use super-computer blue gene at VLSCI to perform molecular dynamic analyses to model the HIV precursor protein oligomerization process.

This project utilizes a combination of structural virology; molecular dynamic simulation; super-computer; and virtual reality typed gaming tools to model the formation of infectious HIV particles in silico. It is expected that these in silico approaches will fill in much of our knowledge gaps in HIV assembly, and to reveal novel aspects of HIV particle formation that is not readily appreciated by static X-ray crystal structure and cryo-EM virus data alone.

There is no live PC3 or PC4 pathogen work required for this project.

Contact supervisor:
Prof. Johnson Mak (Deakin Medical School): johnson.mak@deakin.edu.au 0439562574

Suitable for: Honours or PhD

34. Understanding the formation of HIV particles

Supervisor/s: Johnson Mak, Keith Khoo

Location: CSIRO Manufacturing Flagship at Parkville, Melbourne

Project description:
HIV protein Gag drives the formation of virus particle. During HIV assembly, roughly 2500 Gag molecules will come together for the assembly of immature particle, which is followed by a proteolytic processing maturation to generate infectious virus particles. The formation of virus particles and maturation process is highly regulated, and the smallest interference of these events can block the replication of HIV. The objective of this proposal is to use a combination of protein biochemistry and biophysics to define the mechanism of HIV assembly for the development of novel anti-viral.

This project utilizes a combination of molecular biology, protein biochemistry, protein biophysics and electron microscopy approaches. The candidate will be taught to produce recombinant protein, to measure the dynamics of viral assembly via isothermal titration calorimetry, sucrose buoyancy gradient, and electron microscopy. Opportunity is also available for the candidate to perform protein crystallization study using crystallization robot and Australian Synchrotron.

There is no live PC3 or PC4 pathogen work required for this project.

Contact supervisor:
Prof. Johnson Mak (Deakin Medical School): johnson.mak@deakin.edu.au 0439562574

Suitable for: Honours or PhD

35. Finding the HIV latently infected cells

Supervisor/s: Johnson Mak, Sahar Eid

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
With combinational anti-retroviral therapy (cART), HIV infected individuals who have access to these treatments can live a relatively normal life with life expectancy approaching non-infected individuals. However, the last trace of HIV latently infected cells in the body has kept these HIV infected individual to maintain their drug intake for the rest of their lives. Our inability to target, to quantify or to locate these latently infected cells represents the only obstacle to cure HIV. It has recently appreciated that many of these latently infected cells might have produce between 1-1000 copies of viral RNA despite no HIV protein is produced. Using fluorescent labeling approaches, we have previously reported a detection method that can identify cells that contain a single copy of HIV nucleic acid. The objective of this proposal is to apply our nucleic acid technology for the development of a protocol that can accurately quantify HIV latently infected cells in the system.

This project utilizes a combination of virology, molecular biology and tissue culture approaches. The candidate will be taught to handle HIV, to use fluorescent imaging and FACS analysis to detect HIV infected cells, and to perform real time quantitative PCR for the analyses.

There is no live PC3 or PC4 pathogen work required for this project.

Contact supervisor:
Prof. Johnson Mak (Deakin Medical School): johnson.mak@deakin.edu.au 0439562574

Suitable for: Honours or PhD

36. A new target to reduce Helicobacter pylori infection

Supervisor/s: Melanie Thomson, Tamsyn Crowley, Sarah Shigdar

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Helicobacter pylori is a spiral-shaped bacterium that infects well over 30% of the world's population making it one of the most common bacterial infections globally. In the early '80s two Australians Robin Warren and Barry Marshall identified H. pylori and suggested a link to the development of stomach ulcers. Following this discovery, the World Health Organisation has declared the bacteria to be a Class 1 carcinogen that invades the mucosal lining of the stomach causing up to 95% of duodenal and up to 75% of gastric ulcers. H.pylori has also been associated with gastric cancer and lymphoma. Treatment for H. pylori includes eradicating the bacteria from the stomach using a combination of organism-specific antibiotics with an acid suppressor and/or stomach protector. This treatment regime is becoming less effective with the use of antibiotics to treat so many patients with various conditions it has become more difficult to eradicate H. pylori due to increasing occurrence of antibiotic resistant strains. This has resulted in up to 35% of patients failing first line antibiotic therapy. Aptamers, small strands of nucleic acids, have been used to target a variety of conditions, such as cancer, in pre-clinical studies. This project will investigate their ability to bind to and kill bacterial 'Superbugs'. As well, we shall investigate the ability of these aptamers to neutralise toxins produced by some bacteria.

Contact supervisor:
Dr. Melanie Thomson (Deakin Medical School): m.thomson@deakin.edu.au (03)5227 2722

Suitable for: Honours or PhD

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

37. I will survive! Understanding how rhoptry proteins help malaria parasites survive in host cells

Supervisor/s: Tania de Koning-Ward, Natalie Counihan

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Malaria is one of the most significant infectious diseases worldwide and is caused by infection with Plasmodium species. In order to invade and survive in host cells, these parasites secrete proteins from a specialised set of organelles that act to remodel the host cell to enhance parasite growth. When parasites infect red blood cells, some of these modifications dramatically alter the shape and function of the cell and this contributes to clinical symptoms of malaria. In particular, we are interested in proteins secreted from a unique organelle called a rhoptry, as these proteins are essential for parasite survival but have an unknown function.

The aim of this project is to investigate how rhoptry proteins gain access to the host red blood cell, and how they remodel red blood cells to make it hospitable for Plasmodium growth. To address these aims, cutting edge technology will be used to create transgenic parasites containing rhoptry proteins tagged with fluorescent proteins. This will allow the trafficking and localisation of proteins to be followed across the cell cycle by live cell imaging. Additionally, rhoptry proteins will be targeted for gene knockdown to determine the effect of protein knockdown on parasite growth and survival.

For this project a diverse range of techniques will be utilised. These include molecular (PCR, cloning, sequencing), protein (expression, purification, western blotting) and cell biological techniques (growth assays, immunofluorescence analysis, live cell and high resolution imaging). Findings from this project will provide a better understanding of how malaria parasites secure their own survival within their host, leading to the development of effective and novel therapeutics.

Contact supervisor:
Assoc. Prof. Tania de Koning-Ward (Deakin Medical School): taniad@deakin.edu.au (03)5227 2923

Suitable for: Honours or PhD

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

38. Infective endocarditis (IE) in the 21st Century

Supervisor/s: Eugene Athan, Melanie Thomson

Location: Barwon Health, Geelong

Project description:
Infective endocarditis in the 21st century continues to be an important cause of morbidity and mortality. It has increasingly become a disease associated with modern health care interventions. Annual incidence of between 3-9 cases per 100,000 persons in developed countries.The highest rates are observed among patients with prosthetic valves, intracardiac devices, or those with a previous history of infective endocarditis such as injecting drug users (IDUs).

The diagnosis of infective endocarditis relies on clinical, microbiologic and echocardiographic findings. Treatment involves antimicrobial therapy targeting the identified pathogen. Surgical indications include heart failure, uncontrolled infection, and the prevention of embolic events. The optimal timing of surgical intervention remains controversial. Mortality remains high despite major recent advances in treatment in particular in those cases caused by Staphylococcus aureus (S. aureus), associated with health care and in prosthetic valve infection. Contemporary multicentre assessments of outcomes in IE have estimated inpatient mortality of between 14-18%.

Despite an increasing incidence, IE remains an uncommon disease. In order to better study this uncommon disease a group of interested researchers in 2000 proposed to establish a multinational prospective cohort of IE. Possible directions for investigation in the future included a new multinational consortium, the International Collaboration on Endocarditis (ICE). This collaboration aims to provide a mechanism to advance the understanding of endocarditis in areas difficult to study without an established network.

We would like to better understand the microbiological and epidemiological features of all cases of infective endocarditis. Laboratory typing of isolates will also be performed.

Techniques to be used include collection of microbiological isolates and analyses of all cases of IE risk factors and patient outcomes.

Contact supervisor:
Assoc. Prof. Eugene Athan (Barwon Health): eugene@barwonhealth.org.au (03)4215 2375

Suitable for: Honours or PhD

This project is subject to final approvals.

39. Device and Biofilm infections: fighting the Super bugs

Supervisor/s: Eugene Athan, Richard Page, Melanie Thomson

Location: Barwon Health, Geelong

Project description:
Joint replacement surgery is now common place in developed countries. This technology has greatly enhance the quality of life of Australians. Infections of bones and joints in particular prosthetic joints remain a major medical and surgical challenge. This is further complicated by the emergence of multiresistant bacterial infections such as methicillin resistant staphylococcus aureus (MRSA), Vancomycin resistant enterococci (VRE) and extended spectrum betalactamase (ESBLs) producing Gram negative organisms.

We propose detailed clinical, epidemiological and microbiological analyses of all cases of orthopedic infections including biofilm studies in vitro and scoping for an in vivo mouse model of prosthetic joint infection.

The project will involve:

- Detailed analyses of clinical cases with orthopedic prosthetic joint infections (PJIs)
- Microbiological analyses of isolates causing infections including biofilm studies
- Development of in vivo mouse model of prosthetic infection.

Contact supervisor:
Assoc. Prof. Eugene Athan (Barwon Health): eugene@barwonhealth.org.au (03)4215 2375

Suitable for: Honours or PhD

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

40. Unravelling the mystery of the flesh eating bacteria

Supervisor/s: Eugene Athan, Melanie Thomson, Daniel O'Brien

Location: Barwon Health, Geelong

Project description:
Mycobacteria ulcerans (Bairnsdale or Buruli ulcer) is a bacterial pathogen found in the environment that continues to cause serious skin and soft tissue destructive disease in Victoria. It is an emerging infectious disease causing significant morbidity in coastal Victoria and in rural west Africa.

It is the third most important mycoabacterial pathogen after TB and Leprosy. Potential environmental and wildlife reservoirs are unknown and the mode of transmission remains unclear. We propose further epidemiological, clinical and microbiological studies to characterise Mycobacteria ulcerans in Victoria.

This project will involve:

- Geographic information system analysis including weather, rainfall, seasonality and land development associated with all cases identified in Victoria
- Epidemiological and clinical analysis of large patient cohort
- Microbiological laboratory analyses of isolates and therapy
- Genotyping of strains
- Serosurvey of human population
- Study of potential animal reservoirs.

Contact supervisor:
Assoc. Prof. Eugene Athan (Barwon Health): eugene@barwonhealth.org.au (03)4215 2375

Suitable for: Honours or PhD

Metabolic Disease

41. Is health in the Pacific being compromised by the importation of unhealthy food products?

Supervisor/s: Colin Bell

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Pacific Islands countries and areas are facing an epidemic of chronic disease with cardiovascular disease, diabetes, chronic respiratory disease and cancer contributing to 80% of all deaths. Pacific countries also have some of the highest rates of diabetes and obesity and these diseases are overwhelming health systems and slowing economic progress through their impact on the labour supply and productivity. Imported food products may be contributing to this burden as evidence from household income and expenditure surveys suggests that 50% or more of household expenditure on food is on imported foods. These proportions may well increase with the introduction of proposed free-trade agreements.

The aim of this research is to describe changes in the amount of food high in fat, sugar and or salt imported into Pacific countries over time.

Publically available trade data from 2000 to 2015 will be analysed to describe change over time in imports of food groups such as sugar sweetened beverages, canned meat, instant noodles, mutton flaps and turkey tails, along with information on country of import and country of export. Where available development aid data will also be collected for comparison.

The research will shed light on the nature of food imports to the Pacific from a public health perspective. Outcomes will include data on food importation that may be useful for policy makers in Pacific countries as they negotiate trade and development aid with their trading partners.

Contact supervisor:
Assoc. Prof. Colin Bell (Deakin Medical School): colin.bell@deakin.edu.au (03)5227 8043

Suitable for: Honours

42. The role of metformin in β-cell regeneration in diabetes

Supervisor/s: Kathryn Aston-Mourney, Yann Gibert

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Diabetes is one of the major health burdens facing the world today. Both type 1 and type 2 diabetes are characterised by a complete or partial loss of the insulin producing cells in the pancreas (β-cells). Human β-cells have a very limited capacity for regeneration however zebrafish are able to completely regenerate their pancreas. Additionally, we have new evidence that the diabetes drug metformin enhances β-cell regeneration in zebrafish.

This project will use a zebrafish model of pancreas ablation and regeneration as well as β-cell lines to determine the gene pathways involved in β-cell regeneration and how they are modulated by metformin.

Identification of the pathways involved in β-cell regeneration may lead to novel drug targets and eventually a way in which the human pancreas can be regenerated thereby curing diabetes.

This project will involve the following:

- Zebrafish breeding and treatment
- Immunohistochemistry
- In situ hybridization
- Cell culture
- Analysis of cell death
- Analysis of cell proliferation
- RNA extraction and Real-time PCR
- Western Blots
- Analysis of insulin secretion and ELISA

Contact supervisor:
Dr. Kathryn Aston-Mourney (Deakin Medical School): k.astonmourney@deakin.edu.au (03)5227 2977

Suitable for: Honours or PhD

43. Characterising the role of novel placental signalling factors in health and disease.

Supervisor/s: Bryony McNeill

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Complications of pregnancy are associated with significant morbidity and mortality to both mother and fetus. In many cases, poor pregnancy outcome can be attributed to impaired placental function. The placenta is a transient organ of pregnancy which serves as the interface between mother and fetus. It is highly metabolically active and produces a range of local and circulating signalling factors which regulate fetal growth and development and maternal physiological adaptations to pregnancy. Of particular importance for a successful pregnancy is the development and maintenance of a placental vascular network which provides nutrients and oxygen to the fetus. Dysregulation of placental signalling pathways resulting in compromised placental blood flow has been implicated in the pathophysiology of many disorders of pregnancy including pre-eclampsia, gestational diabetes and intrauterine growth restriction. Our laboratory is particularly interested in the role of a group of vascular signalling factors including C-type natriuretic peptide, nitric oxide and hydrogen sulfide, which have recently been identified as possible therapeutic targets in the treatment of hypertensive conditions of pregnancy. The current project will investigate the role of novel signalling pathways in the placenta using a range of advanced physiological, cell and biochemistry techniques. This study will have implications for identifying targets for improving maternal-fetal wellbeing and pregnancy outcome.

Contact supervisor:
Dr. Bryony McNeill (Deakin Medical School): bryony.mcneill@deakin.edu.au (03)5227 2018

Suitable for: Honours

44. Evolution and function of omega-3 during embryonic development in zebrafish

Supervisor/s: Yann Gibert, Prusoth Yogananthara

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The Omega-3 fatty acid DHA is important for brain function. It is derived from the 18:3n3 linolenic acid. In vertebrates, linolenic acid is converted into DHA by the action of delta6 desaturase and delta5 desaturase. The phenotypic consequences of a lack of these enzymes during embryonic development remains unknown. The vertebrate model zebrafish has the unique feature of having in its genome a desaturase with both delta5 and delta6 activity. In this project we will genetically knock-down the zebrafish delat5/6 desaturase enzyme and study its consequences during development with a particular focus on brain development. Moreover this project will study brain formation when excess omega 3 are delivered to the developing zebrafish brain. This project will allow to understand what the function of omega 3 delivery is during normal embryonic development. This project aims to understand the function of omega 3 during brain formation in vertebrate by depleting the enzyme used to make omega 3 and study the brain morphology and lipid content resulting from this depletion.

Contact supervisor:
Dr. Yann Gibert (Deakin Medical School): y.gibert@deakin.edu.au (03)5227 1197

Suitable for: Honours or PhD

45. Differences in characteristics between those who fracture and those who remain fracture-free

Supervisor/s: Kara Holloway, Sharon Brennan-Olsen, Julie Pasco, Lana Williams

Location: Barwon Health, Geelong

Project description:
Fractures are a major public health concern because they are expensive in terms of diagnosis (e.g. X-rays) and management (casts, surgery, rehabilitation, etc). They can also result in a loss of independence which can lower a personâ€™s quality of life. A person can also need to take time off work after a fracture, resulting in a loss of income. Foot fractures are particularly important in this regard, because a fracture at this site can result in a person not being able to drive for several weeks. Individuals who sustain fractures often have comorbidities, or health behaviours that can affect the risk profile for fracture.

The candidate working on this project will describe the characteristics of individuals with fracture and fulfil a major public health goal to identify specific risk factors for fractures, allowing the prediction of those who will most likely fracture. Incident fracture cases have been identified from radiology reports that are collated to form a comprehensive fracture register for our region. Using a nested case-control study design, the candidate will use data from the Geelong Osteoporosis Study (GOS) cohort/s and from the GOS fracture-register to compare and contrast fracture cases with non-fracture controls to identify differences in characteristics. This could include diet, alcohol consumption, physical inactivity, education level, quality of life, anxiety/depression, and exposure to medications and diseases. Post-fracture data regarding use of health services (such as length of hospital stay, GP visits, physiotherapists, etc.) will also be analysed. This project will be undertaken within the Epi-Centre for Healthy Ageing, located in the IMPACT SRC (Innovations in Mental and Physical Health and Clinical Trials).

Contact supervisor:
Dr. Kara Holloway (Barwon Health): khollo@barwonhealth.org.au (03)4215 3335

Suitable for: Honours or PhD

46. Modifiable risk factors for chronic disease: a population-based study

Supervisor/s: Julie Pasco, Sharon Brennan-Olsen, Lana Williams, Kara Holloway

Location: Barwon Health, Geelong

Project description:
The burden of chronic disease in Australia is poised to escalate as life expectancy increases and the population ages. It is of great public health importance to promote healthy ageing and minimise risk profiles for chronic diseases at a population level. This project will utilise data from the Geelong Osteoporosis Study to focus on building an evidence base for our region that describes the prevalence of modifiable risk factors thereby identifying targets for intervention. Potential targets include smoking, alcohol abuse, physical inactivity, poor diet, malnutrition, hypertension and obesity.

The candidate will work closely with the research team at the Epi-Centre for Healthy Ageing, in the Innovations in Mental and Physical Health and Clinical Trials Strategic Research Centre (IMPACT SRC), situated at Barwon Health. The project will foster an appreciation of epidemiological study design, sampling techniques, participant-researcher interaction, database design and management, and statistical analysis.

Contact supervisor:
Prof. Julie Pasco (Barwon Health): juliep@barwonhealth.org.au (03)4215 3331

Suitable for: Honours or PhD

47. The role of miRNA in the development of cardiac hypertrophy

Supervisor/s: Paul Lewandowski

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Cardiac hypertrophy is a potential life threatening disease that often develops in patients with hypertension. While quite common in patients with high blood pressure it is not entirely clear whether the condition develops as a consequence of hypertension, or whether it may actually be a trigger for the development of increased blood pressure. There is a need to understand the various mechanisms and pathways involved in the development of cardiac hypertrophy to find effective means of diagnosis, prevention and treatment. The disease is a concern as complications due to end organ damage resulting from chronic exposure to increased blood pressure can be adverse and fatal. To study cardiac hypertrophy Dr Lewandowski's laboratory has completed a number of preliminary studies using animal and cell culture models that suggest a number of miRNA are associated with the development of the cardiac hypertrophy.

This project will provide students with the opportunity to learn cell culture skills along with those needed to modulate miRNA expression in vitro. Specifically the miRNA species miR-218, miR-466b, miR-675*, miR-490* or miR-351. In addition the project also incorporates Gene expression analysis, Protein electrophoresis & Immunoblotting, Biochemical analysis, Enzymatic analysis and Histological Analysis.

Contact supervisor:
Assoc. Prof. Paul Lewandowski (Deakin Medical School): paul.lewandowski@deakin.edu.au (03)5227 1111

Suitable for: Honours or PhD

48. The role of nutrition in the development of cardiac hypertrophy

Supervisor/s: Paul Lewandowski

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Cardiac hypertrophy is a potential life threatening disease. There is a need to understand the various mechanisms and pathways involved in the development of the condition to find effective means of diagnosis, prevention and treatment. The disease is a concern as complications due to end organ damage resulting from chronic exposure to increased blood pressure can be adverse and fatal. To study cardiac hypertrophy Dr Lewandowski's laboratory has developed a novel rat model of the condition that they employ to study the development of the disease and its treatment. Interestingly when rat pups are weaned from being milk fed by their mothers onto solid food there is an association with the onset of cardiac hypertrophy. The current project will investigate the genetic and environmental triggers that may contribute to the development of cardiac hypertrophy through modifying the diet of rats during the crucial weaning period.

This project will provide students with the opportunity to learn animal surgical techniques and skills needed to run a dietary trial. In addition the project also incorporates Gene expression analysis, Protein electrophoresis & Immunoblotting, Biochemical analysis, Enzymatic analysis and Histological Analysis.

Contact supervisor:
Assoc. Prof. Paul Lewandowski (Deakin Medical School): paul.lewandowski@deakin.edu.au (03)5227 1111

Suitable for: Honours or PhD

49. Fast Foods: Harmful effects of food products on the intestine and liver

Supervisor/s: Leni Rose Rivera

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Excessive amounts of certain components of the modern diet have been implicated in multiple organ failure. These include excessive fats, sugars and advanced glycation end products. The first vulnerable organ to encounter these substances is the intestine and there is increasing recognition that intestinal damage contributes to downstream effects. For example increased gut permeability (leaky gut) is associated with nonalcoholic fatty liver disease (NAFLD). Gut-derived bacteria and endotoxin occur in the circulation in NAFLD.

Advanced glycation end products (AGEs) are complexes of reducing sugars and proteins formed when proteins are overheated in the presence of fats and sugars (e.g. by deep frying). They are low in traditional diets but are common in so-called fast foods. We have evidence that AGEs are detrimental to intestinal and liver function. We have discovered receptors for AGES (RAGEs) in the intestine. This project builds on preliminary data that indicates that AGEs precipitate or exacerbate NAFLD which is predicted to become the leading cause of cirrhosis, end-stage liver disease, and ultimately liver transplantation. This project will provide you with the opportunity to conduct experiments that closely link animal models and human disease. Technologies that will be used include high resolution confocal microscopy, immunohistochemistry, histochemistry, in vivo and in vitro physiology, and molecular biology.

Contact supervisor:
Dr. Leni Rose Rivera (Deakin Medical School): leni.rivera@deakin.edu.au 0402419758

Suitable for: Honours or PhD

This project is subject to final approvals.

50. Discovery of new drugs for the treatment of diabetes

Supervisor/s: Kathryn Aston-Mourney, Ken Walder

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Type 2 diabetes is one of the major health burdens facing the world today. Diabetes is characterised by failure of the insulin producing cells in the pancreas (β-cells). β-cell failure is progressive, with patients requiring additional medications over time and eventually insulin injections. Furthermore, given that despite best practice management, more than 50% of patients with type 2 diabetes have poor glucose control, the development of new and superior drugs for the treatment of type 2 diabetes is imperative.

We have generated a novel drug screening platform using a β-cell gene expression signature (GES) that is indicative of the overall health and functionality of the cells. In this project we aim to apply this platform to screen a compound library for novel drugs that can protect β-cells in a diabetic environment. Candidate drugs will then go on to in vitro and in vivo testing for their ability to slow, halt or even reverse β-cell decline. Discovery of such drugs will greatly improve the treatment prospects and quality of life for millions of people with diabetes.

The project will involve the following:

- RNA extraction and purification
- Real-time PCR
- Culture and treatment of cells
- Analysis of insulin secretion
- Analysis of cell death
- ELISA
- Treatment and metabolic testing in mice

Contact supervisor:
Dr. Kathryn Aston-Mourney (Deakin Medical School): k.astonmourney@deakin.edu.au (03)5227 2977

Suitable for: Honours or PhD

51. Anti-inflammatory properties of self-assembling peptides

Supervisor/s: Ken Walder, Richard Williams

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Self-assembling peptides are a novel tool for producing functional bio-nanomaterials. These peptides can be manipulated to produce structures that mimic larger and more complex biological systems, and have the potential to become bioactive through presentation of biochemical and biomechanical signals in a context similar to the extracellular matrix. In this project we will produce novel self-assembling peptides designed to have anti-inflammatory properties, and test the effects of these peptides on markers of inflammation in cultured macrophage cells, in both the basal and activated states. Measurement of gene expression and protein levels and activity will be investigated to determine both the effects and the mechanism of action of the peptides in the cells. It is expected that the project will involve sequential modifications of the self-assembling peptides to determine effects of structural changes on anti-inflammatory activity, with the ultimate aim of identifying highly bioactive, non-toxic, anti-inflammatory self-assembling peptides.

Contact supervisor:
Prof. Ken Walder (Deakin Medical School): walder@deakin.edu.au (03)5227 2883

Suitable for: Honours

52. Discovery of new targets for the treatment of diabetes

Supervisor/s: Kathryn Aston-Mourney, Ken Walder

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Type 2 diabetes is one of the major health burdens facing the world today. Diabetes is characterised by failure of the insulin producing cells in the pancreas (β-cells). β-cell failure is progressive, with patients requiring additional medications over time and eventually insulin injections. Current diabetes treatments cannot stop or slow the progression of β-cell failure; therefore it is vital that we obtain a better understanding of how β-cell failure occurs and how it could be targeted by new treatments.

We aim to characterize the role of several genes and pathways identified from our recent next generation sequencing experiments in a cell model of β-cell failure. This will provide novel information and targets for the development of new drugs to treat type 2 diabetes.

The project will involve the following:

- Genetic manipulation of cells
- Analysis of insulin secretion
- Analysis of cell death
- RNA extraction and purification
- Real-time PCR
- Western blotting
- ELISA

Contact supervisor:
Dr. Kathryn Aston-Mourney (Deakin Medical School): k.astonmourney@deakin.edu.au (03)5227 2977

Suitable for: Honours

53. Modulation of TXNDC12 to treat type 2 diabetes and cardiovascular disease

Supervisor/s: Ken Walder, Briana Spolding

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Type 2 diabetes and cardiovascular disease are two of the most serious health challenges facing Australia and the developed world. The prevalence of these diseases continues to increase, and current treatment options are failing to improve outcomes for most patients. We have discovered a novel mechanistic link between type 2 diabetes and cardiovascular disease, involving impaired processing of pentraxin 3 and adiponectin by the endoplasmic reticulum protein TXNDC12, which results in reduced plasma levels of pentraxin 3 and adiponectin, and increased risk of developing type 2 diabetes and cardiovascular disease. In this project we will confirm the actions of TXNDC12 on processing and secretion of these key proteins, and show that knockdown of TXNDC12 function by RNA interference reduces their release from adipocytes in cell culture.

These studies will involve the use of recombinant adenoviruses to suppress TXNDC12 in cultured adipocytes, and measurement of key endpoints using real-time PCR, Western blot and ELISAs. We will also test the effects of increasing TXNDC12 levels in adipose tissue of obese and diabetic (db/db) mice using recombinant adeno-associated viruses. Key endpoints associated with both metabolic and cardiovascular disease will be measured, including body weight and body fat content, circulating levels of glucose and insulin, glucose tolerance, energy metabolism by indirect calorimetry, and cardiac function using echocardiography.

Contact supervisor:
Prof. Ken Walder (Deakin Medical School): walder@deakin.edu.au (03)5227 2883

Suitable for: Honours or PhD

This project is subject to final approvals.

54. Investigating the stability of dietary intakes over time

Supervisor/s: Felice Jacka, Julie Pasco

Location: Barwon Health, Geelong

Project description:
This project takes place in the setting of a large ongoing cohort study of women. The project entails a detailed investigation of dietary intakes in women participating in the ongoing Geelong Osteoporosis Study (GOS), which comprises a sample of nearly 1000 women from across the adult age range. The project will involve a validation of the initial technique used for estimating dietary intakes from food diaries and a further assessment of dietary intakes and how they vary or otherwise over 15 years of follow up. Understanding the trajectory of diet quality and its stability or otherwise is very important in extrapolating findings from observational studies. The student will be based in Geelong and co-supervised by Professor Julie Pasco. Students will gain hands on experience in data analysis and the writing of sophisticated research reports for publication. They will have exposure to a wide range of research projects being undertaken in the setting of the IMPACT SRC. This project would ideally suit those with a psychology or a nutrition background.

Contact supervisor:
Assoc. Prof. Felice Jacka (Barwon Health): f.jacka@deakin.edu.au 0422194218

Suitable for: Honours or PhD

Musculoskeletal Medicine

55. Indigenous status and the risk of fracture

Supervisor/s: Sharon Brennan-Olsen, Julie Pasco, Lana Williams, Kara Holloway

Location: Barwon Health, Geelong

Project description:
An increased likelihood of mortality following a fracture of the hip or spine is well-documented across the world. Although fracture rates are known to vary widely between countries, little is known of the secular trends in fracture incidence for Indigenous persons compared to non-Indigenous persons in Australia. Incident fracture cases of osteoporotic sites (hip, wrist, spine, and humerus) will be identified from radiology reports that are collated to form a comprehensive fracture register for our region. Indigenous status will be ascertained from a hospital-based administrative database, and fracture rates in Indigenous persons will be compared to those of non-Indigenous persons according to age, sex and fracture site. The project will foster an appreciation of epidemiological study design, data linkage and statistical analysis, and presents the opportunity to utilize the unique and comprehensive fracture register to generate clinically useful information. Furthermore, outcomes from this project have the potential inform future health communications regarding fracture risk. This project will be undertaken within the Epi-Centre for Healthy Ageing, located in the IMPACT SRC (Innovations in Mental and Physical Health and Clinical Trials) at Barwon Health, as part of the newly formed Social Epidemiology Research Group.

Contact supervisor:
Dr. Sharon Brennan-Olsen (Barwon Health): sharob@barwonhealth.org.au (03)4215 3334

Suitable for: Honours or PhD

56. Childhood asthma and the risk of fracture

Supervisor/s: Sharon Brennan-Olsen, Julie Pasco, Lana Williams, Kara Holloway

Location: Barwon Health, Geelong

Project description:
There are a number of reasons children with asthma may be more susceptible to fracture, which include the use of beta agonists and corticosteroid medications, differences in activity levels and the disease process itself. However, these associations have not yet been examined for the Geelong and surrounding districts. The aim of this study is to compare fracture rates in children with and without asthma.

In 2005, the Geelong Childhood Asthma Study identified a community-based sample of primary school aged children with asthma. Incident fracture cases will be identified from radiology reports that are collated to form a comprehensive fracture register for our region. Fracture rates in children identified as having asthma will be compared with fracture rates from the general community of primary school aged children that do not have asthma. The project will foster an appreciation of epidemiological study design, data linkage and statistical analysis. This project presents the opportunity to utilize good quality data from two large community-based projects to generate clinically useful information. This is a collaborative project between the Geelong Osteoporosis Study and Dr Peter Vuillermin, Paediatrician. The candidate will work closely with the research team at the Epi-Centre for Healthy Ageing, in the Innovations in Mental and Physical Health and Clinical Trials Strategic Research Centre (IMPACT SRC), situated at Barwon Health.

Contact supervisor:
Dr. Sharon Brennan-Olsen (Barwon Health): sharob@barwonhealth.org.au (03)4215 3334

Suitable for: Honours or PhD

57. Sarcopenia and nutritional risk, falls and functional mobility

Supervisor/s: Julie Pasco, Sharon Brennan-Olsen, Lana Williams, Kara Holloway

Location: Barwon Health, Geelong

Project description:
There is great diversity in the health and wellbeing of the elderly population. Changes in nutritional status and body composition affect disease risk and quality of life, and can influence the need for aged-care. This project will focus on components of sarcopenia (age-related muscle wasting and muscle weakness) that are key determinants of falls, functional mobility and independence. There is a gap in knowledge about how malnutrition impacts on age-related muscle deterioration and the sequelae of this decline in our region. This project will inform the evidence base for preventing disability associated with the onset and progression of frailty, and sustaining independence and good quality of life.

This quantitative project involves new and existing data from participants of the Geelong Osteoporosis Study. During data collection, analysis and interpretation, the candidate will work closely with the research team at the Epi-Centre for Healthy Ageing, in the Innovations in Mental and Physical Health and Clinical Trials Strategic Research Centre (IMPACT SRC), situated at Barwon Health.

Contact supervisor:
Prof. Julie Pasco (Barwon Health): juliep@barwonhealth.org.au (03)4215 3331

Suitable for: Honours or PhD

58. Ageing, chronic disease and quality of life

Supervisor/s: Sharon Brennan-Olsen, Julie Pasco, Lana Williams, Kara Holloway

Location: Barwon Health, Geelong

Project description:
Quality of life (QoL) is a broad and multifactorial construct. The fundamental right of every individual is to enjoy the highest attainable standard of wellbeing and health, however this ability is influenced by age, sex, physical capabilities, disease and social and personal resources. This project is designed to investigate the relationship between ageing, chronic disease/s and QOL among men and women enrolled in the Geelong Osteoporosis Study The student will measure QoL by questionnaire using a country-specific validated World Health Organisation (WHO) QoL tool. Data pertaining to chronic disease will be ascertained from a combination of clinical measurements, medical histories and self-reported information. The student will learn and employ regression techniques to determine associations between age, chronic disease and QoL in the four psychosocial domains of physical, mental, social and environment. This project will be undertaken within the newly formed Social Epidemiology branch of the Epi-Centre for Healthy Ageing, located in the IMPACT SRC (Innovations in Mental and Physical Health and Clinical Trials) at Barwon Health.

Contact supervisor:
Dr. Sharon Brennan-Olsen (Barwon Health): sharob@barwonhealth.org.au (03)4215 3334

Suitable for: Honours or PhD

59. Binge alcohol drinking and bone health in young adults

Supervisor/s: Julie Pasco, Kara Holloway, Sharon Brennan-Olsen, Lana Williams

Location: Barwon Health, Geelong

Project description:
There is evidence to suggest that intoxication with alcohol affects bone turnover and impacts on the structural integrity of the skeleton. Binge alcohol drinking is recognised as a public health issue, but little is known about bone health in this context. This project will new and existing data collected by the Geelong Osteoporosis Study. The aim of this project is to investigate alcohol consumption and its association with measures of bone structure including bone mineral density at multiple sites, trabecular bone score at the spine and ultrasound of the heel, together with markers of bone turnover in the blood.

The candidate will work closely with the research team at the Epi-Centre for Healthy Ageing, in the Innovations in Mental and Physical Health and Clinical Trials Strategic Research Centre (IMPACT SRC), situated at Barwon Health. The project will foster an appreciation of epidemiological study design, sampling techniques, participant-researcher interaction, database design and management, and statistical analysis.

Contact supervisor:
Prof. Julie Pasco (Barwon Health): juliep@barwonhealth.org.au (03)4215 3331

Suitable for: Honours or PhD

60. Identifying underlying causes of developmental craniofacial and musculoskeletal defects

Supervisor/s: Alister Ward, Nicole Stupka

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The ADAMTS enzyme family of zinc-dependent metalloproteinases is highly conserved across species and acts as key regulators of various developmental processes, including craniofacial and musculoskeletal development. Of particular interest is ADAMTS-15, a poorly characterised family member, which is highly expressed in developing craniofacial structures and skeletal muscle.

ADAMTS-15 cleaves versican, an extracellular matrix proteoglycan widely expressed in developing structures. Versican synthesis and remodelling regulates various aspects of cell behaviour relevant to craniofacial and musculoskeletal development, including proliferation, migration, differentiation and apoptosis. Using a muscle cell culture model, we have recently shown that remodelling of a versican rich pericellular matrix is necessary for membrane contact and myoblast fusion during myofibre formation. Dysregulation of versican synthesis and remodelling is associated with pathology, including muscular dystrophy and cleft palate. The biological function of versican remodelling by ADAMTS-15 and the downstream regulation of signalling pathways relevant to craniofacial and skeletal muscle development has to date not been described.

Using a novel Adamts15 knockout mouse model in combination with a versican-deficient knockout mouse, we will undertake a comprehensive analysis of gene expression and cell signalling pathways known to regulate craniofacial development and skeletal muscle development to determine which genetic pathways are perturbed in Adamts15 mutants. Experimental techniques used may include in situ hybridization, immunohistochemistry, histology, semi-quantitative real time PCR, immunoblotting and muscle function testing.

Contact supervisor:
Prof. Alister Ward (Deakin Medical School): award@deakin.edu.au (03)5227 2041

Suitable for: Honours or PhD

61. Oxidative Stress and the Matrix: Implications for Muscle Repair

Supervisor/s: Nicole Stupka

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The connective tissue (extracellular matrix) that surrounds muscle fibres and their progenitor cells is more than a scaffold to provide structural support; it is a dynamic tissue that sends signals to muscle fibres and progenitor cells to regulate all aspects of cell behaviour, including inflammation and repair following injury. For optimal skeletal muscle health, connective tissue composition and remodelling of its constituent components need to be carefully regulated. Oxidative stress and pro-inflammatory cytokines activate signalling pathways which disrupt the protein composition of the extracellular matrix leading to fibrosis and loss of contractile function.

Duchenne muscular is a fatal X-linked genetic disease caused a mutation in the DYSTROPHIN gene. The functional protein is not expressed rendering muscles vulnerable to injury leading to degeneration, muscle fibre loss due to ineffective repair, expansion of the extracellular matrix and fibrosis. Excess oxidative stress and pro-inflammatory cytokines in dystrophic muscles contribute to disease pathology and accelerate the functional decline.

We are investigating how oxidative stress and inflammation affect the composition, remodelling and expansion of the extracellular matrix and the downstream consequences for skeletal muscle repair and function in dystrophy. It is evident that to ameliorate the pathology of Duchenne muscular dystrophy, the dysregulation of the extracellular matrix must be targeted. Therefore, we are characterising the function of some novel candidate proteins, including the extracellular proteoglycan versican, ADAMTS proteases which remodel versican, and the antioxidant protein selenoprotein S (SEPS1), which has been implicated in inflammation and oxidative stress.

Using cell culture and transgenic mouse models relevant to Duchenne muscular dystrophy, this Project will examine the roles of those genes in the context of inflammation, regeneration and muscle function.

Contact supervisor:
Dr. Nicole Stupka (Deakin Medical School): nstupka@deakin.edu.au (03)5227 3160

Suitable for: Honours or PhD

Neuroscience

62. Bad food, bugs, and the brain. How diet influences gut microbiota and mood

Supervisor/s: Felice Jacka, Laura Gray

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The incidence of obesity is increasing across the developed world, bringing with it a rise in cardiovascular and metabolic problems. Less well recognised, but equally detrimental to health and quality of life, is the increased risk of depression associated with poor diet. Our rapidly developing understanding of the aetiology underpinning these disorders suggests that changes in the bacterial population of the gut may be the common link which leads toboth peripheral and psychiatric symptoms.

The gut microbiota are intrinsically sensitive to diet, and in particular the types of fat in the diet. Changes in gut microbial populations have been linked to changes in mood, behaviour and cognition, but as yet we do not have a clear understanding of how these complex systems interact. We therefore propose to examine whether different components of the diet can modulate gut microbiota, how this relates to behaviour and mood, and the underlying cellular and molecular mechanisms of this interaction.

The student involved in this project would develop skills in animal behavioural testing, metabolic profiling, molecular biology, biomarker analysis and data analysis. The student would be encouraged to develop their knowledge of metabolic disorders, immunology, neurochemistry and psychiatric neuroscience, at an interface between disciplines that is a rapidly growing and very exciting area of research. The student would be encouraged to develop their independence in the laboratory with support and guidance from engaged and enthusiastic supervisors. This project represents an opportunity to be involved in a novel and innovative study with strong prospects for continuing and diverse research, and most importantly, direct benefits for patient health.

Contact supervisor:
Assoc. Prof. Felice Jacka (Deakin Medical School): f.jacka@deakin.edu.au 0422194218

Suitable for: Honours or PhD

This project is subject to final approvals.

63. Action of dopamine and antipsychotics on bone formation in zebrafish

Supervisor/s: Yann Gibert, Michael Berk, Lana Williams

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Antipsychotics are amongst the most commonly used medications, and their use for schizophrenia and related conditions tends to commence in early adulthood and be lifelong. Both dopamine (DA) and antipsychotics affect bone metabolism. In one study, DA-transporter (DAT)-deficient mice displayed a low bone mass phenotype. However their role during bone formation is still unknown.

This project will investigate the effects of DA and selected antipsychotics on bone development during zebrafish embryogenesis. At the time of bone induction, at 48 hours post fertilization (hpf) zebrafish embryos will be exposed to DA, and selected antipsychotics until fixation at 72, 96 hpf or 5.5 days pf (dpf). Resulting phenotype on bone development will be monitor by Alizarin red staining for mineralised tissue, alkaline phosphatase for osteoblast lineage. All staining will be performed at 5.5 dpf. Expression of several genes markers of bone development will be investigated by whole mount in situ hybridisation (WISH): runx2a and runx2b (for osteoprogenitor cells), osterix and osteocalcin (for differentiating osteoblast), alkaline phosphatase, and colagen10a1 (for mature osteoblast) and matrix metalloproteinase 9 (for osteoclast lineage). WISH will be performed at 72 or 96 hpf depending of the probe used. This project will definitively linked dopamine and antipsychotic and bore formation in vertebrates

Contact supervisor:
Dr. Yann Gibert (Deakin Medical School): y.gibert@deakin.edu.au (03)5227 1197

Suitable for: Honours or PhD

64. Psychiatric disorders, treatment and medical comorbidities

Supervisor/s: Lana Williams, Julie Pasco, Sharon Brennan-Olsen, Kara Holloway

Location: Barwon Health, Geelong

Project description:
Psychiatric disorders impose huge costs, both on the individual and the community, yet we have an incomplete understanding of their impact on lifestyle, social and in particular medical factors. The aim of this project is to investigate psychiatric disorders, their treatment and medical co-morbidities in men and women participating in the Geelong Osteoporosis Study. Mood, anxiety and personality disorders will be assessed utilising the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Non-patient edition (SCID I & II) and psychological symptomatology using the Hospital Anxiety and Depression Scale (HADS). Information on demographic, lifestyle, medication use and somatic illness is obtained via questionnaire. The project will utilise epidemiological study methods; regression techniques will be used to determine associations between psychological disorders and symptoms and various health outcomes.

This project will be undertaken within the Psychiatric Epidemiology branch of the Epi-Centre for Healthy Ageing, located in the IMPACT SRC (Innovations in Mental and Physical Health and Clinical Trials) at Barwon Health.

Contact supervisor:
Dr. Lana Williams (Barwon Health): lanaw@barwonhealth.org.au (03)4215 3303

Suitable for: Honours or PhD

65. Lithium compared to quetiapine as maintenance therapy after a first episode of mania

Supervisor/s: Michael Berk, Mohammadreza Mohebbi

Location: Barwon Health, Geelong

Project description:
Structural neuroimaging studies have demonstrated progressive changes in bipolar disorder. Lithium and quetiapine are efficacious treatments for bipolar disorder but their neuroprotective effect in humans remains sparsely investigated in humans. Our team has conducted a randomised, controlled trial comparing these two agents after a first episode of mania. Subjects were diagnosed with mania as part of bipolar I disorder, schizoaffective disorder (bipolar type), or a substance-induced mood disorder, and had not been treated for a manic episode before. Patients were stabilized on the combination of lithium and quetiapine for acute mania, and were randomized to either lithium or quetiapine after stabilization. An unmedicated healthy control sample was collected as well. Clinical, brain imaging and neuropsychological data were collected. The current project involves data exploration of factors that may predict outcomes of treatment. The student would be required to have knowledge of and competence in statistical techniques to explore the dataset.

Contact supervisor:
Prof. Michael Berk (Barwon Health): mikebe@barwonhealth.org.au (03)4215 3320

Suitable for: Honours

66. Clinical factors involved in the effects of N-acetyl cysteine treatment in depression

Supervisor/s: Olivia Dean, Michael Berk, Mohammadreza Mohebbi

Location: Barwon Health, Geelong

Project description:
Depression is one of the most common mental illnesses and confers one of the largest disease burden in Australia. While standard antidepressant treatment is effective, there is often a shortfall between treatment and full recovery. The IMPACT SRC has completed a randomised, placebo controlled trial of N-acetyl cysteine as an add-on to standard treatment for people with depression. N-acetyl cysteine is an acetylated amino acid that has been shown to have benefits as an add-on therapy for depression. The trial has been completed with 273 participants included in the available data set. The current project involves data exploration of factors that may predict outcomes of treatment. The student would be required to employ statistical techniques to explore the data set. Factors to be included in the analyses are functioning, quality of life, adverse events and symptom change. While the project has clear aims, there is scope for the student to select data based on their own interests and scientific relevance. This is an opportunity to be involved in clinical research with clear translatable outcomes.

Contact supervisor:
Dr. Olivia Dean (Barwon Health): oliviad@barwonhealth.org.au (03)4215 3300

Suitable for: Honours

67. Slingshotting drugs into the brain to treat CNS disorders

Supervisor/s: Sarah Shigdar, Wei Duan, Joanna MacDonald

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
The blood brain barrier is impenetrable to the vast majority of drugs. This is a formidable barrier which protects the brain against harmful chemicals and is generally considered to be a good thing in healthy people. However, this makes treating brain disorders such as brain cancer or neurodegenerative disorders very difficult as treatments must pass through this barrier to get to the tumour. Recent developments in brain physiology have shown that targeting and binding to receptors on the cells of the blood brain barrier will transport molecules across this formidable barrier into the brain. We have designed smart small nucleic acids that can target specific tumour cells. These small drugs are known as aptamers and they can transport drugs directly into tumour cells. This project will investigate the ability of an aptamer specifically designed to target a receptor on the cells of the blood brain barrier to be transported into the brain. This can then be used to generate a novel drug delivery system which will slingshot a targeted drug delivery molecule across the blood brain barrier and directly to the brain tumour or diseased brain cells.

This project will use flow cytometry, confocal microscopy, molecular biology techniques and cell culture.

Contact supervisor:
Dr. Sarah Shigdar (Deakin Medical School): sarah.shigdar@deakin.edu.au (03)5227 2846

Suitable for: Honours or PhD

68. Are Medical Students healthy? An assessment of chronic disease factor prevalence

Supervisor/s: Colin Bell, Erik Martin

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Chronic diseases such as cardiovascular disease, diabetes, chronic respiratory diseases and cancer are the leading causes of illness and death in Australia and health professionals are not spared. Given their youthfulness, medical training and interest in health, it is reasonable to assume that medical students have healthy diets, are physically active, don't smoke and use alcohol responsibly, placing them at low risk of chronic disease. However, the sedentary nature of their training and the stress associated with performing well in a demanding and fast-tracked medical course may increase their risk.

Using recognised surveillance tools and techniques, dietary, physical activity, tobacco and alcohol related behaviours and depression, anxiety and stress will be assessed by online questionnaire. Weight, height, waist circumference and blood pressure will also be assessed along with fasting blood glucose and total and HDL cholesterol using capillary blood from a finger prick.

This project will shed light on chronic disease risk in repeat cross-sections of approximately 135 medical students at Deakin University. It will also shed light on whether awareness of chronic disease risk at a young age is likely to stimulate behaviour change.

Contact supervisor:
Assoc. Prof. Colin Bell (Deakin Medical School): colin.bell@deakin.edu.au (03)5227 8043

Suitable for: Honours

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

Rural and Regional Health

69. Help-seeking for mental wellbeing among young members of farming families

Supervisor/s: Susan Brumby, Scott McCoombe

Location: National Centre for Farmer Health, Hamilton Victoria

Project description:
Many barriers to seeking help with mental health and wellbeing have been described for members of farming communities, from geographical distance to inequitable resource allocation and restrictive patterns of normative behaviour. Research in this area has predominantly focused on adult populations, while the needs of adolescent and young adult community members are less well understood.

This study will assess the barriers and enablers to help seeking for mental health and wellbeing among teenage and young adult members of farming families (aged 15-25), and draw comparisons with a non-farming, age and sex-matched cohort in a rural town setting. The study will utilise qualitative and quantitative methods including structured interview and targeted questionnaires, to identify relevant factors in this population.

Contact supervisor:
Dr. Susan Brumby (Deakin Medical School): susan.brumby@deakin.edu.au (03)5551 8533

Suitable for: PhD

This project is subject to final approvals.

70. Cholinesterase Research Outreach Project: Measuring pesticide exposure in western Victorian farmers

Supervisor/s: Susan Brumby, Jacquie Cotton, Scott McCoombe

Location: National Centre for Farmer Health, Hamilton Victoria

Project description:
Organophosphates are a common class of pesticides that act on cholinesterase receptors, and have been associated with chronic neurological diseases such as Parkinsonâ€™s in sheep farmers. However the critical window for exposure to toxicants may occur years before the onset of neurological symptoms, and current protocols are lacking in options for the long-term monitoring of farm worker organophosphate exposure and risk. The study aims to assess if integration of accurate cholinesterase monitoring and counselling in relation to safe use of organophophates during health screenings is an effective tool to reduce toxic exposure, and therefore stabilise or increase cholinesterase activity in this cohort.

This study will utilise quantitative analysis of physical assessment and biochemical parameters, including anthropometric, fasted total serum cholesterol, triglycerides, low-density cholesterol (LDL), high-density cholesterol (HDL), blood glucose, erythrocyte cholinesterase activity of farmers exposed to agricultural organophosphate pesticides in their workplace, compared to the levels in farmers who do not use organophosphate-based chemicals, and the integration of cholinesterase monitoring into routine agricultural health clinics. Investigators will work with health care providers to provide farming people with a link between their cholinesterase activity and their organophosphate agrichemical use. Further qualitative and quantitative analyses of barriers to long term monitoring and adherence to such programs will also be investigated.

At the honours level, students involved with this project will be based at Waurn Ponds, and be required to undertake a minimum of 3 field-work trips in Hamilton and the Western Districts (Victoria) with staff from the National Centre for Farmer Health. PhD candidates will be involved in extensive field-work in the Western Districts, and will require a Victorian Drivers Licence.

Contact supervisor:
Dr. Susan Brumby (Deakin Medical School): susan.brumby@deakin.edu.au (03)5551 8533

Suitable for: Honours or PhD

71. Injury and its association with ageing in western Victoria

Supervisor/s: Julie Pasco, Kara Holloway, Sharon Brennan-Olsen, Lana Williams

Location: Barwon Health, Geelong

Project description:
This project is associated with the larger study known as Ageing, Chronic Disease and Injury in western Victoria (ACDI). The overall objective of ACDI is to collect new data and draw on existing information collected by various agencies to provide a detailed snapshot of the health and safety of people living in western Victoria. The region encompasses 21 Local Government Areas, including Geelong, and extends along the coast in the south to the south-Australian border in the west, and beyond Ballarat and Horsham in the north. The region has pockets of older populations that are somewhat remote and isolated, particularly those living on farms. The aim of this particular project is to establish the extent of certain types of injury in the region and its relationship to age and geographical location. This information is required to identify gaps and to plan changes to services and infrastructure to better serve the community.

The candidate will work closely with the research team at the Epi-Centre for Healthy Ageing, in the Innovations in Mental and Physical Health and Clinical Trials Strategic Research Centre (IMPACT SRC), situated at Barwon Health. The project will foster an appreciation of epidemiological study design, sampling techniques, participant-researcher interaction, database design and management, and statistical analysis.

Contact supervisor:
Prof. Julie Pasco (Barwon Health): juliep@barwonhealth.org.au (03) 4215 3331

Suitable for: Honours or PhD

72. Space allocated for fruit and vegetables and the relationship with health in Australian farmers

Supervisor/s: Paul Lewandowski, Vanessa Vaughan, Scott McCoombe, Susan Brumby

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Dietary patterns may be influenced by the availability and accessibility within shops/stores to different types of foods. In urban areas it has been shown that measurements of shelf space devoted to the sale of items such as fruit and vegetables can be used by researchers to characterize the healthfulness of the food environment. Such investigations have occurred in lower socioeconomic regions of the US. However, little is known about the amount of shelf space used for healthy and unhealthy foods in different types of shops/stores in rural areas. There is a small amount of data from rural Texas in the US, however the food and cultural environment in those locations is very different from regional and rural Australia. Thus there is a need to determine if the availability of healthy or 'junk' foods relates to the health of Australian's who live and shop in regional areas.

This project will provide students with the opportunity to travel throughout Victoria to survey the range of foods available for sale in regional supermarkets and other food outlets. This will involve collecting in store food inventories, measurements of space allocated to different types of foods, collection of diet diaries from shoppers in the food outlets, carrying out food frequency surveys and data analysis.

Contact supervisor:
Assoc. Prof. Paul Lewandowski (Deakin Medical School): paul.lewandowski@deakin.edu.au (03)5227 1111

Suitable for: PhD

73. Hepatitis C regional centre outcomes

Supervisor/s: Eugene Athan, Jon Watson, Amanda Wade

Location: Barwon Health, Geelong

Project description:
Hepatitis C virus (HCV) is one of the most commonly reported notifiable diseases in Australia. Approximately 297,000 people in Australia have been exposed to HCV. Three-quarters of those exposed are chronically infected. Between 10 - 40% with chronic HCV infection develop cirrhosis of the liver, and are at risk of dying from cirrhotic complications or hepatocellular carcinoma. HCV is now the most frequent indication for liver transplantation in Australia.

In the Barwon Region, the "Liver Clinic" at The Geelong Hospital provides the following services for HCV infected patients:

- A weekly clinic staffed by rotating consultant gastroenterologist and infectious diseases physicians, registrars, specialty nurses, a psychiatrist and a general practitioner with an interest in drug and alcohol treatment.
- A separate nurse run clinic for initial assessments.
- A shared care program involving general practitioners.
- A community outreach nurse.
- An outreach consulting service to Barwon prison.
- To improve access to treatment for patients infected with HCV in the Barwon Region, with the objective of increasing the number of patients who complete treatment and avoid long-term complications of HCV infection.
- To perform an audit of the clinical services currently provided for HCV treatment, and to use this information to maximise access, efficiency, efficacy and throughput.
- To ensure that any structural changes to the services are consistent with a patient centred approach to HCV treatment.

Quantitative analysis of data extracted from medical records and database of treated patients. Qualitative interview with general practitioners involved in the shared care program.
Qualitative interview with patients attending the Liver Clinic to explore barriers, attitudes to and acceptability of treatment services.

Contact supervisor:
Assoc. Prof. Eugene Athan (Barwon Health): eugene@barwonhealth.org.au (03)4215 2375

Suitable for: Honours

This project is subject to final approvals.

74. Antimicrobial Stewardship measures of success

Supervisor/s: Eugene Athan, Gerard Gill

Location: Barwon Health, Geelong

Project description:
Can education interventions improve antibiotic prescribing in General Practice? Antimicrobial Stewardship (AMS): curbing the unnecessary use of antimicrobials is the best defence against resistant microbes. AMS is an organised program that aims to reduce the inappropriate use of antimicrobials to provide the best clinical outcomes & reduce any adverse consequences that include drug toxicity, antimicrobial resistance & financial costs. Such programs utilise antimicrobial restriction, approval systems or electronic decision support tools to optimise prescribing. Successful in the acute hospital setting in many countries around the world. There is limited evidence from other countries in community general practice where the majority (80%) of antibiotic prescribing in Australia is initiated.

Baseline audits of antibiotic prescribing in 3 pilot GP clinics. Templates for these audits are already undertaken at hospital level. Implementation of education intervention: to encourage the Review of the patient on day 3 of commencement of therapy and followed by consideration of stopping most antibiotic therapy by day 7.

"R3-S7" this will include 2 hour face to face training conduct by ID specialist & AMS pharmacist. Develop or modify Online learning package for GPs prescribing for common clinical conditions.

Develop specific Professional Development tool for RACGP in conjunction with the NPS. We will then repeat antibiotic prescribing audits after 3 & 6 months, 1 year utilising patient electronic records of 2-4 weeks and Medicare NPS data systems at the pilot practices. Analyse time trends in prescribing compliance over the course of the intervention examining rates & significant differences in time.

0We will monitor C. difficle incidence rates in the region from SJOG pathology before and during intervention. Detailed economic evaluation of the intervention to estimate potential & real savings to public health expenditure and prevention of C. difficle disease cases.

Contact supervisor:
Assoc. Prof. Eugene Athan (Barwon Health): eugene@barwonhealth.org.au (03)4215 2375

Suitable for: Honours or PhD

This project is subject to final approvals.

Additional projects

75. The importance role of female leadership in building healthy & sustainable agricultural communities

Supervisor/s: Susan Brumby, Scott McCoombe

Location: National Centre for Farmer Health, Hamilton Victoria 3300

Project description:
Women play a vital role in the global rural workforce, comprising nearly half of all agricultural workers, and are critical to healthy and sustainable agricultural communities. However, internationally and nationally women are not well recognised for their contributions to farming. They are also poorly represented in leadership positions in the agriculture sector. The face of Australian agriculture is predominantly that of the middle-aged white male. Women are under-represented in agricultural politics, senior positions in private and public sector bodies, and the decision-making processes of farm organisations.

This project will research the 20 women selected to receive the "Victorian women in agriculture scholarship to Washington DC" in the late 1998's and address the question “Was the Victorian women in agriculture scholarship effective in building leadership capacity for the longer term among rural women”? The scholarship was awarded to women with leadership roles or leadership potential in the agriculture sector to assist them to build their skills and networks.

Using a mixture of qualitative methods such as case study, in depth interviews and quantitative survey this project will investigate the pathways they have followed to their current positions and their roles as leaders in building healthy and sustainable agricultural communities. It will explore the existence of structural and cultural impediments, which may act to restrict women's access to leadership. The student will also explore the effectiveness of initiatives - such as these scholarships - in supporting women to overcome impediments and gain and sustain leadership roles in the agriculture sector.

The student will be required to undertake a literature review, design data collection tools, undertake interviews, analyse both qualitative and quantitative data and report.

Contact supervisor:
Dr. Susan Brumby (Deakin Medical School): susan.brumby@deakin.edu.au 0355518533

Suitable for: PhD

This project is subject to final approvals.

76. The effect of BCM-7 on T cell development

Supervisor/s: Karen Dwyer, Yann Gibert

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
Type 1 diabetes (T1D) is the most common childhood autoimmune disease, the incidence of which has increased by 2-3 fold over the last 50 years. Twin studies provide strong evidence for non-genetic influences and environmental exposure to dietary antigens, specifically the consumption of A1 beta-casein in cows' milk, have been implicated in epidemiological studies. We have shown that diabetic prone mice fed a diet supplemented with the beta casein A1 have an increased rate of Type 1 diabetes. A1 casein is cleaved in the gut to BCM-7 a bioactive peptide of 7 amino acids. We have shown that these mice have fewer regulatory T cells and we hypothesise that BCM-7 is impacting T cell development within the thymus. In this project we aim to characterize the effect of BCM-7 on T cell development and tracking in a zebrafish model.

Summary of techniques to be used:

- Immunohistochemistry and live cell microscopy
- Quantitative RT-PCR and enzyme assays
- Zebrafish handling and analysis
- Whole mount in situ hybridization
- Micro-injection into oocytes
- Microscopy and confocal microscopy

Contact supervisor:
Prof. Karen Dwyer (Deakin Medical School): karen.dwyer@deakin.edu.au (03)52271421

Suitable for: PhD

77. The effect of the novel adenosine receptor agonist VCP746 on beta-cell biology

Supervisor/s: Tharun Mysore, Karen Dwyer, Yann Gibert

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Project description:
The clinical picture of diabetes arises due to beta cell failure. In the case of Type 1 diabetes beta cell destruction occurs; in Type 2 diabetes the beta cell fails to produce enough insulin for the prevailing insulin resistance. Beta cell regeneration is thus a potential avenue to compensate for this beta cell loss. There is evidence that beta cell regeneration is mediated by signaling via the adenosine A2A receptor. The clinical use of adenosine receptor agonists however is limited by the unwanted on-target effects of hypotension and bradyarrthymias, a consequence of the widespread expression of adenosine receptors. We have access to a novel adenosine bitopic agonist VCP746. This agent has a unique chemical structure and previous experiments have shown that it activates the adenosine receptors without producing these unwanted cardiac effects. In this research project we will examine the effect of VCP746 on islet biology in zebrafish and on isolated mouse islets.

Summary of techniques to be used:

- Mouse islet isolation, culture & analysis
- Immunohistochemistry and live cell microscopy
- Quantitative RT-PCR and enzyme assays
- Mouse handling, injections and testing
- Cloning of adenosine receptors in zebrafish
- Whole mount in situ hybridization

Contact supervisor:
Dr. Tharun Mysore (Deakin Medical School): t.mysorebharath@deakin.edu.au (03)52279367

Suitable for: Honours or PhD

78. Adenosine signaling in renal ischaemia reperfusion injury

Supervisor/s: Karen Dwyer, Yann Gibert, Tharun Mysore

Location: School of Medicine, Deakin University, Waurn Ponds Campus

Project description:
There is extensive data implicating a role for adenosine signaling in protecting against renal and cardiac ischaemia reperfusion injury in mice. The limitation of this model is that ischaemia is induced in only one organ at a time. Significant interplay exists between the patho-physiological response of the heart and the kidney after an ischaemic event. Clinically both organs are usually affected concurrently. The aim of this project is to develop a novel model for ischemic research by establishing a model of hypoxia reperfusion in adult zebrafish whereby hypoxia is induced simultaneously in the heart and kidney and examine the effect of adenosine signaling. This project will also study the effects of ischemia during the process of heart and kidney regeneration in adult zebrafish.

Summary of techniques to be used:

- Immunohistochemistry and live cell microscopy
- Quantitative RT-PCR and enzyme assays
- Zebrafish handling and analysis
- Molecular biology
- Mutagenesis by CRISPR/Cas9 in zebrafish
- Microinjection in oocytes
- Microscopy and confocal

Contact supervisor:
Prof. Karen Dwyer (Deakin Medical School): karen.dwyer@deakin.edu.au (03)52271421

Suitable for: Honours or PhD