School of Science and Health

Table of Contents

Project Title 46: Measuring plasticity in the healthy brain.

Supervisory team: Dr Siobhan Schabrun; Prof Lucy Chipchase

Contact information for Supervisor:
Dr Siobhan Schabrun (02) 4620 3497 s.schabrun@uws.edu.au

Project Description

Brain plasticity is a relatively new concept that refers to the brains ability to change as a result of experience. As health care practitioners, brain plasticity is important for learning new skills and rehabilitating people after injury or disease. Brain plasticity can be measured using a form of non--- invasive brain stimulation known as transcranial magnetic stimulation (TMS). Despite being in widespread use, the number of recordings that need to be made with TMS to ensure reliable and consistent results is unclear. The current literature uses a range of recordings from 12 to 15 to 30 (or even 60) with no consensus on the most appropriate number. This project seeks to determine how many recordings are required for reliable and consistent results. This work will be the first to set a standard in the field for the number of recordings needed in studies that examine plasticity in the healthy brain and also in neurological and musculoskeletal disorders. As such, we anticipate a peer-reviewed publication will arise from this work that should be highly cited in future.

Project Aims

To determine how many TMS recordings are needed to provide a reliable and consistent measure of brain plasticity.

Project Methods

This study will use already available data from numerous studies conducted by our research group over the last 5 years in healthy individuals and in those with pathological conditions. The data will be divided into different numbers of recordings (12; 15 or 30) and these data compared to determine the number of recordings that provide the most reliable and consistent findings. Basic analyses will be conducted in Excel and statistical analyses in Sigmaplot.

Although, this particular project will not involve direct data collection, there will be plenty of opportunities to observe and participate in TMS studies that are ongoing in our lab. In addition, we currently have a number of Honours and PhD students who will be willing to talk to you about their pathways to academic and research work. Thus, you will have opportunities to gain skills and knowledge in the measurement and analysis of brain plasticity data as well as working and collaborating with a number of research higher degree students and academics. Our laboratory has a very collegial approach to mentoring and supporting beginning researchers. We have already supervised one UWS Research Student who, last

year, won the prize for best presentation at the colloquium at the end of the program.

Opportunities for Skill Development

A number of outcomes are anticipated in terms of skill development:

1. Knowledge and skills in the assessment of brain plasticity;
2. Skills and experience with transcranial magnetic stimulation and analyses;
3. Skills and experience with quantitative data analyses;
4. Experience working collaboratively and professionally with a strong and varied research team. As part of this team, you will also attend research meetings, listen to discussions and presentations from current Honours and PhD students;
5. Development and mentoring regarding how to communicate research in the form of oral presentations and publications;
6. Authorship on a peer---reviewed paper.

Students are required to have the following skills to apply

This study will suit students who have completed units in human anatomy or physiology and have a strong interest in the human brain. The study would suit students in a health science program (e.g. physiotherapy, occupational therapy, exercise science, medicine) or a biomedical science/physiology program. Students can be in any year of their program, but should have a keen interest in developing skills in brain plasticity; have a high GPA, and be interested in developing their research skills with a view to considering further research in the future (e.g. Honours or PhD pathways). Our laboratory also suits students who have a strong drive to succeed and to learn from leaders in the field.

Project Title 47: Studying Ice Nucleation Protein Motifs with NMR Diffusion Measurements.

Supervisory team: Prof. William S. Price

Contact information for Supervisor:
Prof. William S. Price (02) 4620 3336 w.price@uws.edu.au

Project Description

Freeze tolerance is important for life that exists in low temperature environments. Protection strategies include the use of antifreeze proteins to prevent ice crystal growth or the use of ice nucleation proteins (INPs).[1, 2] INPs initiate ice formation earlier so that the organism has a chance to respond to the freezing for thermal protection or could be used as a means of retrieving nutrients from plants.[1] INPs are thought to bind to water molecules in a way that resembles an ice crystal[3] such that further nucleation is promoted but the mechanism is not fully understood. Studying translational diffusion[4] and hydration of these proteins in aqueous solutions at various temperatures is pertinent for understanding this and would be of interest for potential applications of these proteins.

Such a project is available to be continued for an Honours project within the group and provides important preliminary research results for grant applications (such as the one recently submitted to the Australian Research Council).

1. Zachariassen, K. E., Kristiansen, E., Cryobiology, 2000, 41, 257 – 279.
2. Graether, S. P., Jia, Z., Biophysical Journal, 2001, 80, 1169 – 1173.
3. Green, R. L., Warren, G. L., Nature, 1985, 317, 645 – 648.
4. Price, W. S., NMR Studies of Translational Motion. Cambridge University Press: New York, 2009.

Project Aims

1. To investigate the diffusion of specific tri-peptides (e.g., TGT) at low temperatures.
2. To investigate hydration changes with the tri-peptides with decreasing temperature.

Project Methods

This project requires the student to measure the diffusion of the molecules in water using the NMR spectrometers in the Biomedical Magnetic Resonance Facility at UWS Campbelltown campus. This could include sample preparation (e.g., making different concentration solutions of the tri-peptides), and will include learning how to run NMR diffusion measurements.

The diffusion measurements will be made over a range of concentrations at one temperature (more if time permits) so that the diffusion at infinite dilution can be

estimated and used to find the Stokes radius using the Stokes-Einstein-Sutherland equation. This will be compared to estimates of the anhydrous effective radius found from chemistry models or other means.

The student would learn about temperature calibration, pulse length calibration, how to set up relaxation and diffusion measurements. The student would also learn about data analysis with software such as Origin Pro and would also use chemistry modelling software such as ChemOffice to estimate the anhydrous volume of the molecules so that estimations of hydration can be made.

Opportunities for Skill Development

1. Gain a basic understanding of NMR diffusion and relaxation measurements.
2. Learn how to use scientific software like Origin Pro and ChemOffice.
3. Learn the use and limitations of the Stokes-Einstein-Sutherland equation for radius estimations.

All of these would be used in higher degree research in the field of NMR diffusion measurements and would prepare a student well for Honours within the group.

Students are required to have the following skills to apply

This project would suit high performing second or t hird year students with a strong multidisciplinary background including chemistry/biochemistry/physical chemistry and maths.

Project Title 48: Examining the evidence base for complementary medicines and therapies for autism spectrum disorder (ASD)

Supervisory team: Professor Caroline Smith; Dr Giselle Gallego

Contact information for Supervisor:
Professor Caroline Smith (02) 4620 3777 caroline.smith@uws.edu.au

Project Description

Autism spectrum disorders (ASD) are developmental disorders characterised by impairment of social impairment, communication and social interaction [1]. In Australia ASD has an estimated prevalence of 12.1 to 35.7/10,000 children [2]. There is no cure for ASD, treatment approaches focus on behavioural interventions, speech therapy, occupational therapy and educational interventions, however due to access to health services and the limitations of standard treatments many parents/carers look for other treatment approaches. Thirty one to 74% of parents/carers of children with ASD have been found to use complementary therapies and medicines (CM), e.g. vitamins, diets, music therapy and acupuncture [3]. Parents may choose to use CM when behaviour problems are severe, and there is a sense of desperation to find a solution. Evidence of the effectiveness of CM with the management of ASD is accumulating however it is frequently conflicting and inconsistent [4].

Smith and Gallego have received funding to undertake a qualitative study examining parents/carers of children with ASD views and understanding of a) the types and sources of information on CM used in decision making, b) what type of information about CM are accepted as evidence, c) the role of scientific evidence in their decision making and, d) to provide an understanding of the meaning "scientific evidence or proof that a therapy works". Together the systematic review and qualitative study will generate the foundation for our future research application. This will aim to develop a support service to assist parents or carers with understanding CM evidence and to ensure that this information is presented in a manner that informs and facilitates their decisions. This is important and relevant with the introduction of the National Disability Insurance Scheme (NDIS) which will "support greater choice for people with disability, and put people in control of the care and support they receive, based on need".

In particular this evidence review will enable us to produce evidence summaries to inform parents/carers and other stakeholders of the safety and benefit or not from specific complementary medicines. Our future research application will involve knowledge translation (KT), this involves consultation with stakeholders and development and testing of novel strategies of communicating findings such as arts based KT strategies, to assist stakeholders with CM decision making.

Clinical and evidence translation is a significant area of research activity at the National Institute for Complementary Medicine. This research concentration

focuses on establishing the evidence base including efficacy and safety of complementary therapies and medicines.

Project Aims

To undertake a systematic review of the complementary medicine literature examining the evidence base for the effectiveness or not, and safety of these modalities with symptom management of autism disorders.

Project Methods

The supervisors will prepare a protocol to guide the student with undertaking the systematic review. The student will receive training with how to undertake a systematic search of the literature, an initial assessment of studies for inclusion/exclusion, undertake data extraction data and a risk of bias assessment. The supervisors will work closely with the student to undertake synthesis of the data, and preliminary meta---analysis if appropriate. Further oversight and assistance will be provided with interpreting data and writing a discussion. The review will focus on English language texts only. The student will be offered authorship of a publication submitted.

During the 8 week scholarship the supervisors will be accessible to the student. The supervisory arrangement will ensure the student has access to supervisors, feels confident to work independently on tasks, and to have access to the necessary resources to complete their work in a timely manner.

The steps and time frame are detailed below:

1. Undertake the search of databases, retrieve studies, determine which studies meet the criteria for inclusion, undertake data extraction and management, undertake assessment of study quality and analysis of results.
2. A meta-analysis of data will be undertaken where feasible.
3. Produce draft evidence summaries to inform parents/carers and other stakeholders of the safety and
4. benefit or not from specific CM for dissemination in phase 4. The wording will also be modified based on the interviews with parents exploring their understanding of evidence.
5. 4 Draft a report for circulation to stakeholders, and prepare an academic paper for submission to a journal.

Week 1 Orientation to the project
Week 2-3 Conduct search and retrieval of studies.
Week 3-4 Select studies and undertake data extraction
Week 5-6 Assessment of risk & treatment effect
Week 7-8 Drafting of preliminary results and discussion

Opportunities for Skill Development

Outcomes from this scholarship for the student will include skill development in relation to research literacy. These will include conducting literature searches, developing critical appraisal skills, communication in relation to writing and presentation skills. They will also have the potential to extend their knowledge base around complementary medicines and therapies as well as autism spectrum disorders.

We anticipate we will have the results from our own qualitative study completed during this time, and the student will have the opportunity to consider the evidence gap and the experiences of parents' decision making regarding complementary medicines.

The skills developed will be of benefit to their ongoing studies, in addition to skills that can be further developed in pathways regarding Honours or a higher research degree.

Students are required to have the following skills to apply

The study will be of interest to students in health science, medicine and nursing in years 2-5. Knowledge of how to search the literature, good writing skills, attention to detail, interest in complementary medicines and or disability research would be advantageous.

Project Title 49: Development of the marsupial immune system.

Supervisory team: Dr Julie Old

Contact information for Supervisor:
Dr Julie Old (02) 4570 1283 j.old@uws.edu.au

Project Description

Marsupials are born with immature immune tissues and are unable to mount specific immune responses. At birth they are very underdeveloped, having only the basic requirements to aid their travel to the pouch and attach to the teat. Marsupials are therefore excellent models for studying the development of the immune system, as unlike eutherian mammals (eg. humans and mice) that develop the immune tissues in the sterile uterine environment, the marsupial immune tissues develop ex-utero in a microbial-rich environment and are easily accessible.

This project will involve investigating the expression levels of key immunological molecules in developing marsupials and have a molecular biology focus. The student will learn RNA extraction, cDNA synthesis, PCR, qPCR, gel electrophoresis, cloning and bioinformatic techniques.

The project will provide information as to when pouch young marsupials first become immune-competent based on when key immunological markers first appear in developing pouch young marsupials. The project will enhance our understanding of the development of mammalian immune systems and comparisons will be made to our own developing immune system.

Project Aims

Determine the expression levels (and hence appearance) of key immunological markers in developing pouch young marsupial immune tissues.

Project Methods

The student will focus on one or two genes, and be part of a larger project investigating the development of the marsupial immune system being conducted. The student portion of the project will build on work initiated over the last few years and aid longer term publication outcomes for UWS. Depending on the outcome of the project a publication including the research conducted by the student is likely.

The student will specifically gain skills in RNA extraction, cDNA synthesis, PCR, qPCR, gel electrophoresis, cloning and bioinformatic techniques using red-tailed phascogales as the model marsupial species. The student will also gain skills in recording data and conducting research. The skills gained will aid UG students aiming to enrol in Honours or HDR projects in immunology or molecular biology.

Opportunities for Skill Development

The student conducting this project will obtain skills in molecular biology (as described above) and immunology as well as data collection and recording. The student may also obtain skills in small native mammal capture and handling.

Students are required to have the following skills to apply

Ideally the student required for this project would be a third year student. It is preferable if the student has a strong background and interest in immunology and/or molecular biology.

Project Title 50: The "Mapping food Environments in Australian Localities" Project (MEALProject): Are there 'food deserts' in Western Sydney?

Supervisory team: Dr Thomas Astell-Burt; Dr Xiaoqi Feng

Contact information for Supervisor:
Dr Thomas Astell-Burt (02) 4620 3714 t.astell-burt@uws.edu.au

Project Description

The epidemics of obesity and non-communicable diseases like type 2 diabetes are driven by modifiable lifestyle risk factors, such as poor diets and sedentary lifestyles. Combined, these issues challenge the sustainability of healthcare in Australia. Evidence suggests that residential environments shape our potential to make healthy choices. Although access is multifaceted, people who live close to fast food retailers but reside long distances to healthier options may be nudged towards diets that are high in fat, salt and low in nutritional content. In the US, this type of context is often referred to as a 'food desert'.

The United States Department for Agriculture (USDA) has defined, identified and mapped 'food deserts' across the US. There is nothing of a comparable nature in Australia, despite an increasingly similar problem with obesity. Research on food access and health has been limited to a small number of Australian cities and using varied techniques, which makes comparisons of the sort promoted by the USDA's work practically impossible. Surprisingly, research in Sydney is rare, despite being the largest city in Australia and containing wide spatial inequalities in obesity and health outcomes.

In short, there is an opportunity to replicate and customise the USDA's approach towards mapping 'food deserts' - and 'food environments' more generally – with consistent definitions across Australia.

The "Mapping food Environments in Australian Localities" Project (MEALProject) is jointly funded by the Western Sydney Medicare Local and the University of Western Sydney School of Science and Health. The investigator team comprises the CIs on this application, as well as Professor Anthony Maeder (UWS) and a senior data analyst (currently under recruitment). The wider aims of the MEALProject are to:

1. review published definitions of 'food desert';
2. consult on which of those definitions are more relevant to the Australian context;
3. quantify and map baseline descriptive measures of 'food deserts' for local areas in Sydney;
4. assess correlations between 'food deserts', diet, obesity and type 2 diabetes in Sydney;

5. synthesise and present findings to key health policy decision makers and interest groups in Australia in order to drive change and build partnerships for future research.

The purpose of this application is to enable a student to come work on the MEALProject in a capacity that will involve them visiting areas of Western Sydney that are objectively defined as 'food deserts', in order to critically evaluate the reality manifesting behind what the data is able to identify. This will involve, for example, assessing the density and nature of food advertising, the cost of standardised food items, and the wider context (e.g. walkability of streets) which is likely to affect how residents in those 'food desert' communities make decisions on what to eat, when, and with whom.

Project Aims

The aims of the part of the MEALProject that the candidate will lead are:

1. To investigate the density and nature of food advertising within 'food deserts' in Western Sydney;
2. To explore the cost of a standardized set of food items across 'food deserts' in Western Sydney;
3. To assess factors relating to the 'obesogenic' environment within 'food deserts' in Western Sydney.

Project Methods

Locations of 'food deserts' in Western Sydney will have already been determined by the MEALProject team prior to the candidate initiating their part of the project. The candidate will visit all, or if there are deemed too many to visit in their entirety, a random sample of the food deserts identified (no more than 5-10). The methods employed by the candidate at each food desert to achieve each of their aims will include previously validated modes of data collection. All data collected by the candidate can be obtained and stored on a smartphone/tablet device within the space of 2-3 weeks, making this project highly feasible within the 8 week overall timeline. An outline for each method is provided below:

1. 'Investigating the density and nature of food advertising': a global positioning device on a smartphone or tablet device will be used to record the locations and types of food advertising observed by the candidate within pre-designated areas within each food desert neighbourhood. The student will then analyse all of this data using basic descriptive statistics to assess whether there are relationships between advert density, the type of food advertised, and other data on each area that is available from the MEALProject database (e.g. food outlets and community demographics).

2. 'Exploring the cost of a standardized set of food items': The Queensland 'Food Basket Survey' is being adapted for smartphone/tablet by the MEALProject investigator team and the candidate will use it to visit a

random selection of food outlets within each food desert. Data collected will be on the cost of a standardized set of food items which are viewed as 'core' (e.g. bread, milk) and 'noncore' (e.g. sugary drinks, chocolate, fried chicken). Once tabulated, the student will then analyse this data using basic descriptive statistics in order to examine how the cost of 'core' versus 'non-core' food items varies within neighbourhoods classified as food deserts in Western Sydney.

3. 'To assess factors relating to the 'obesogenic' environment': While collecting data for each of the first two aims, the candidate will be asked to keep a fieldwork diary, take photographs and to fill in a simple 10-question multiple choice questionnaire that gauges their own perceptions of the neighbourhoods in which they are visiting. The questionnaire will be made available by the MEALProject team for smartphone/tablet and adapted from the 'Neighbourhood Environment Walkability Scale', which assesses perceptions of neighbourhood safety, attractiveness, walkability, greenery, civility and resources. Questionnaire data will be analysed by the candidate using basic descriptive statistics to assess for variation in neighbourhood perceptions within food deserts. These quantitative analyses will be augmented by observations from the fieldwork diary and photographs.

Opportunities for Skill Development

The student will have a solid experience of conducting research in the field of social epidemiology, using multiple data gathering techniques and a grounding in basic descriptive statistics.

It is anticipated that this work will be developed into a scientific paper for publication in a relevant public health journal (e.g. Health and Place), with the candidate taking a substantial role in the authorship.

As the MEALProject is part funded by Western Sydney Medicare Local, there may also be an opportunity for the candidate to get useful experience presenting their work to this key stakeholder, depending upon their time commitments.

Students are required to have the following skills to apply

The candidate must meet the essential criteria as outlined by the program. They will also need to:

1. Have an interest in food and health.
2. Own, and have experience of using a smartphone or tablet device.
3. Be prepared to spend time outdoors in a selected group of neighbourhoods in Western Sydney.

Project Title 51: Obese and Anorexic yeast: a functional genomics approach to identify cellular processes affecting metabolism of neutral lipids in Saccharomyces cerevisiae. Implications for health and biofuel production.

Supervisory team: Dr Gabriel Perrone

Contact information for Supervisor:
Dr Gabriel Perrone (02) 4620 3286 g.perrone@uws.edu.au

Project Description

This project aims to exploit the availability of extensive expertise and capacity in the laboratory for high throughput functional genomics to identify the cellular processes that affect production and storage of triglycerides (fat) and sterol esters under different nutrient/growth conditions. The approach will use genome-wide sets of S. cerevisiae gene deletion mutants and an established high-throughput flow cytometry screening and will identify the interrelationship between altered gene function and environment with lipid metabolism. This approach will not only identify genes that effect the amount of storage lipids but also shed light on the mechanisms involved in lipotoxicity, the latter is associated with failure to convert excess fatty acids into neutral (storage) lipids. Altered lipid metabolism has been strongly implicated in diseases including atherosclerosis, diabetes and metabolic syndrome, and, neurodegenerative disorders including Alzheimer's disease.

While the has been much studies conducted on the genes directly involved in fatty acid synthesis and those involved in synthesis and catabolism of storage lipids, the is little understanding of how neutral lipids storage is influenced on a genome-wide scale and how this is influenced by changes in nutritional state. The project will not only yield data contributing to our understanding of lipid metabolism in health and disease but also for production of biodiesel (biofuel) of which the is much interest in use of triglycerides as a viable source or renewable energy production for biotechnological production of fuels for vehicles and airlines. The latter
aspect of the project will flow on from the identification of genes that promote increased triglyceride (fat) production.

The specific strains that the student will screen will be the genome-wide set of yeast deletion mutants of non-essential genes (4500 strains). The precise condition(s) that the cells will be grown under prior to analysis of neutral lipid content will be determined by progress and findings closely related work conducted by existing students in the laboratory (Ms Caitlin Mcluckie-honours and Mr Alex Phrakaysome-PhD, see further details below). As such while the project will have clear objectives and specific outcomes in mind, since much research will be conducted between now and the commencement of the project an appropriate decision relating to the most appropriate format of any experiments will be determined closer to the commencement of the Summer Scholarship students start date.

Once the student has conducted the screen they will then analyse their genome-wide data set and determine the next series of appropriate experimentation. The student in conjunction with existing lab members also play a role in the interpretation of data and development of hypotheses.

This project will contribute to key strategic research areas of the School and University: Microbiology (FoR code 0605) and Biochemistry and Cell Biology (FoR code 0601).

This work will not only provide important data for a future grant proposal but also for internal (School and UWS grants), and ARC discovery and or ARC linkage grant proposals.

Project Aims

1. The aim of this project is to use a genome---wide approach to identify genes affecting the level of storage lipids in cells.
2. The project will also aim to investigate the effect of nutritional state on Lipids.

Project Methods

The project will use:

1. Microbiology and molecular techniques
2. Genomic screening and high throughput flow cytometry to investigate lipid metabolism.
3. Fluorescence microscopy
4. Analysis and modelling of genome---wide data sets (i.e. systems biology).

Opportunities for Skill Development

T The project will expose the student to a world class research environment and leading edge techniques in yeast genetics, biochemistry and cell biology.

The project will afford training and development of expertise in high throughput genomic screening approaches to investigate lipid metabolism. The project will also provide invaluable training in the use of high throughput flow cytometry, fluorescent microscopy and analysis of genome---wide data sets (i.e. systems biology). The project will also provide fundamental microbiology and molecular skills in growth

and handling of *S. cerevisiae*.

Since the data generated by this project will provide an important contribution to a quality research publication the student will also be involved with all aspects of data interpretation and communication including preparation and submission of a peer-reviewed journal article.

The skills that the applicant would learn will also be invaluable for further studies during honours and/or any subsequent HDR studies.

Students are required to have the following skills to apply

A strong background in biochemistry, genetics and microbiology. The project is directed at a 3rd year student looking to undertake honours in the School of Science and Health in 2015.

Due to the nature of the project it would also be of benefit if the students have direct experience in use of yeast in a research setting.

Project Title 52: Ecological function of turtles in the Murray River: Risks of extinction and human-induced changes in the structure of food webs**.**

Supervisory team: Dr Ricky Spencer

Contact information for Supervisor:
Dr Ricky Spencer (02) 4570 1962 r.spencer@uws.edu.au

Project Description

This project will be directly supported by an ARC Linkage Grant and UWS Partnership grant. The project will lead directly to publications, but will also introduce the candidate to a large Murray River turtle research project and potential honours projects in 2015.

Turtles are evolutionary survivors. Their hard protective shell and longevity has allowed them to survive 220 million years of natural selective pressures. But the combination of rapid, human-induced, changes (invasive species, harvesting and river regulation) has led to nearly half of all turtle fauna either endangered or extinct in the wild and without strategic intervention, much of the turtle lineage will be extinct by the end of the 21st century. Murray River turtles were listed as threatened or endangered in 2013, and their rapid decline, predicted by Thompson (1993), may finally be occurring. Besides their conservation value as an iconic native vertebrate, the rapid decline of Murray River turtles may have far greater implications for the entire ecosystem, because their biomass is a similar magnitude to fish (Thompson 1993), and their role in the food chain is likely to be complex and diverse, yet completely unknown. Given their longevity, however, anthropogenic changes to the River ecosystem through the introduction of invasive species (eg. Foxes and European Carp) and changes in water management may only now be manifesting into population declines and local extinctions.

Three species of freshwater turtle inhabit the Murray River– the broad-shelled turtle (Chelodina expansa), the eastern snake-necked (or long---necked) turtle (Chelodina longicollis), and the Murray short-neck turtle (Emydura macquarii). Each species is likely to differ significantly in their trophic position in the food web. Emydura macquarii may be the primary vertebrate scavenger in the ecosystem, facilitating nutrient flow by consuming carrion, such as dead European carp (Spencer et al. 1998). Chelodina expansa is an obligate carnivore that feeds on fish and crustaceans (Chessman 1983). Within the constraints of its obligate carnivory, C. longicollis is a catholic and opportunistic feeder, consuming a range of dietary items from planktonic crustaceans to carrion (Chessman 1984). The species in this assemblage share a wide habitat distribution (i.e.occupy all available areas across productivity gradient) but vary substantially in abundance within the gradient. Coexistence and variation in abundance may be due to species-specific differences in resource requirements or use (i.e., diet generalist vs. specialist).

Most research on trophic interactions in Murray River ecosystems have centred on changes in fish populations. Overfishing (harvesting) is often regarded as a major

driver of initial population declines, but subsequent destruction of habitat, alteration of river flows, and invasion by introduced species now means there are numerous competing hypotheses about factors constraining their recovery. One widely held view is that feeding lower in the food chain by detritivore species, such as European Carp (Cyprinus carpio), has effectively redistributed energy once available to upper level predators. Altered flooding regimes may have reduced the pool of energy that drives production in many lowland rivers. These ecosystem---type impacts on food chain energetics are fundamental to understanding ecosystem function. Murray River wetlands have an assemblage of both predatory and omnivorous freshwater turtles and a large proportion of predator---prey interactions, as well as, nutrient recyclers in the food web, include turtles.

Thus, evaluating trophic relationships among turtles and other consumers is a prerequisite to understanding the impact that a rapid decline of turtles would have on the properties of Murray River ecosystem function.

Project Aims

This project will use stable isotopes and food web analyses to examine trophic level position and function of each species of turtle relative to habitat and environmental gradients (eg. salinity).

Project Methods

Research into trophic interactions and ecosystem function will be conducted in eight lagoons of the Gunbower lagoon systems. Habitats consist of lagoons that are permanent water/unregulated, permanent water/regulated, temporary wetland/unregulated, each of which have at least one lagoon located in agricultural and forested areas. The biotic and abiotic environmental correlates chosen for measurement at each lagoon were considered a priori to be those most likely to be important to the abundance of turtles. I have identified Eighteen biotic and abiotic environmental correlates that are likely to be important to the abundance of turtles (Aresco 2010). These include abiotic factors, resources (bottom---up), and predator (top---down) characteristics in 6 general categories: (1) maximum surface area of each lake (2) primary substrate type, (3) physiographic region, (4) lake primary productivity, (5) macrofauna, (6) turtle predator presence. Primary productivity of each of the eight lagoons will be measured in terms of (a) standing crop biomass of macrophytes (kg wet weight/m2), (b) percent lake surface area covered with macrophytes (c) periphyton productivity (g/m2/y), and (d --- f) concentrations (µg/L) of chlorophyll a, nitrogen, and phosphorus. (See Aresco (2010) for methodologies). Macro and micro-invertebrates will also be sampled in each habitat (see Spencer et al. 1998 for methodologies). Fish surveys were undertaken by the NCCMA in the summer of 2012/2013 and data on composition and abundances are available.
Correlates between species specific abundance and habitat variables will be analysed via standard univariate and multivariate (eg. Anosim, Simper, PC) analyses.

We will collect tissues from primary producers, invertebrates, and vertebrates in each habitat. Tissue samples from turtles, snakes, frogs, and alligators will be obtained from either muscle of road---killed individuals on roads and highways

surrounding each lagoon or by claw clips taken from live individuals (Aresco 2005). Fish will be sampled using standard techniques, but we will also engage with local angling clubs to coordinate tissue collection. Particulate organic matter (POM), a mix of phytoplankton, diatoms, macroalgal fragments and detritus, may represent a distinct basal resource in the shallow littoral zone and will be sampled seasonally. Similarly, stable isotope values of zooplankton and macroalgae may vary temporally and samples will be collected seasonally. Open water zooplankton and POM samples will also be collected (see Aresco 2005). Macro---algal samples will be collected from mats in the littoral zone, from stems of macrophytes (eg. Valisnaeria and water lilies) and from carapaces of live turtles. Other than claw samples, it will also be possible to take samples from various layers of juvenile turtles. Distinct growth annuli remain visible and accessible for up to 5-10 years in turtles and samples from various parts of the carapace will provide an insight of ontogenetic shifts in diet, as well as indications of changes in the environment. All samples will be freeze-dried and we will use ANSTO's services to quantify δ13C and δ15N isotope ratios of each sample. Because δ13C of consumers that feed on the same prey have similar isotope values and reflect the δ13C of their prey, it is possible to use stable isotope values to determine the sources of primary production in the food web. The δ15N isotope will be used to quantify within population variation in trophic position. Trophic level and food web construction using isotopes will be conducted by methods developed by Aresco (2010). Gut contents of turtles will also be determined to compare with stable isotopes values, which reflect diet items that are actually digested and assimilated, not those that were either undigested or digested but assimilated at lower rates (Gannes et al. 1997). For example, a species may ingest a large volume of plant material but may not have the digestive physiology to digest and assimilate plant tissue. Therefore, in order to fully elucidate food web structure and interpret stable isotope data, it is important to understand how the results of stable isotopes and gut contents analysis compare with each other.

Opportunities for Skill Development

This will be introduced to a large field project, cutting edge laboratory techniques, and food web/population analyses.

The result of this project will be at least one publication for the candidate, as well as assist in the developing of an honours project for 2015.

Students are required to have the following skills to apply

The Candidate will also be supported by a Post-doctoral fellow that will be employed on the ARC Linkage grant.

Project Title 53: Systematic review of interventions to promote healthy lifestyle for employees planning to retire.

Supervisory team: A/Prof Dafna Merom; Mr Paul Fahey

Contact information for Supervisor:
A/Prof Dafna Merom (02) 4620 3796 (d.merom@uws.edu.au)

Project Description

As Australia confronts an unprecedented aging of the population, identifying effective strategies that address processes of aging and their adverse health outcomes have emerged as a major public health and economic challenge. An average worker today can look forward to approximately 15 years of retirement and increasing number may be retired for nearly one quarter of their life. After retiring from work people may lose roles that provide purpose and opportunities to be socially engaged. Further, with aging there is increased probability for chronic health conditions, physical and cognitive limitations which can be reduced or ameliorated with physically active lifestyle.

Quantitative and qualitative reviews of the status of physical activity from before and after retirement highlighted that retirees from high SES increased their leisure time physical activity after retirement and they do so for several reasons including expected health benefits, lifelong PA patterns, opportunities for socialising, personal challenges, and the desire for a new routine. However, employees from low SES not only reduced their physical activity they also attributed low value of physical activity to their life. Although there are a wide range of retirement planning programs being offered by government, private industry and organizations many target the financial preparation and planning. Regardless of the narrow focus, here is no rigorous research that evaluates any of these programs. The purpose of this project is to systematically review interventions that have been implemented for adults in transition to retirement, to characterised the intervention according to their focus, population studied, outcomes thoughts to be achieved and quality of the evaluation.

Project Aims

1. Systematically review the literature on intervention to prepare for retirement, following the recommendations and methods of the industry standard 'Cochrane Handbook for Systematic Reviews of Interventions' (http://www.cochrane.org/handbook)

2. Combine the findings of relevant studies by conducting meta---analysis using the statistical package R.

3. Compile the findings from the systematic review and meta---analyses for submission to a peer reviewed journal following the industry standard PRISMA guidelines (http://www.prisma---statement.org/).

Project Methods

1. With input from A/Prof Merom and her network of experts, develop definitive inclusion and exclusion criteria for the literature search.
2. Develop the data collection instrument (consistent with the Cochrane Guidelines) in Microsoft Excel.
3. With the expert assistance of School librarian Katrina Chaudhary, identify the relevant search engines and prepare the search code for the literature search
4. Download the title and abstract of all papers returned by the search into the EndNote reference management software.
5. Delete duplicates, then review first titles then abstracts of all papers, rejecting all papers which are obviously not consistent with the inclusion criteria.
6. Download full copies of all remaining papers. Two investigators will independently review the methods and results of each, rejecting any papers which are not consistent with the inclusion and exclusion criteria.
7. All remaining papers will be included in the systematic review. Two investigators with independently complete the data collection for each. Disagreements will be resolved by discussion and/or the third investigator.
8. Prepare the qualitative tables and associated text which comprise the systematic review.
9. Under the expert guidance of Paul Fahey extract the relevant outcome data in Excel and read it into R for meta-analysis.
10. Undertake the meta---analysis using the metafor package in R. Prepare the Figures and associated text which comprise the meta---analysis.
11. Guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines, write up the research for publication in a peer reviewed journal.

Opportunities for Skill Development

1. Collaborating in a research team.
2. Time management.
3. Precise scientific descriptions such as inclusion and exclusion criteria, data collection items.
4. Working with literature search engines/ library skills.
5. Critical review of published journal articles (through identifying compliance with inclusion and exclusion criteria and correct identification of study characteristics and outcomes in the data collection process, and summarizing results in the systematic review)
6. Software: Excel, Endnote and R
7. Statistical analysis skills (interpreting and sometimes translating statistical findings in published journal articles into a form appropriate for meta-analysis, conduct meta-analyses and interpret the results)
8. Scientific writing skills (preparing a paper for journal publication)
9. Add a first---author publication to their CV.

Students are required to have the following skills to apply

Strong background in (health) research methods and statistical methods.

Aptitude for logic and critical thinking.

Strong writing skills. Preferable motivated person for HDR from the field of health sociology, health psychology.

Project Title 54: Design and Synthesis of Discrete homo/herometallic cages as Nanocarries for Drug Delivery.

Supervisory team: Dr Feng Li; Prof. Janice Aldrich-Wright

Contact information for Supervisor:
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Project Description

The self-assembly of coordination cages has continued to receive considerable attention over the past decade,[1-3] because of their many potential applications in drug delivery, gas adsorption catalysis, magnetic materials, host-guest phenomena and synthetic membranes for ion channels. Although a number of coordination cage types have been developed, the design and successful construction of these systems, particularly those with heteronuclear coordination motifs, still represents a significant challenge. The design of suitable organic ligands and the selection of the correct metal ions for favouring structure-specific self-assembly play important roles in the construction of discrete coordination cages. Thus much attention in this project will be focused on the synthetic approach and the structural control of coordination architectures, especially for those with multidimensional structures. This will elucidate fundamental aspects of metallo-supramolecular chemistry (including the role that both metal ions and organic species may play in the assembly process), factors influencing host-guest inclusion behaviour and the nature of electronic/magnetic interactions between spin-crossover and magnetic coupling energies. Three synthetic procedures have been successfully exploited for the construction of discrete homo\heteronuclear coordination architectures: 1) exploitation of the inherent coordination properties between ligands and metal ions for the metal-directed assembly of discrete metallo-supramolecular architectures; 2) formation of discrete metallo-assemblies preorganised for binding a second metal ion, or ions, to yield discrete heterometallic architectures; 3) employing preformed metalloligands functionalised for use as building blocks reacting with additional metal ions and sometimes extra ligands. On the other hand, such nano-cages with mesoporous sizes will be explored as nanocarriers for drug delivery. Here our interest is in the investigation of a new load-and release mechanism applied to drug delivery via soluble SCO nano-cages by the tuning of two spin states.

1. Feng Li, Natasha F. Sciortino, Jack K. Clegg, Suzanne Neville, Cameron J. Kepert (2014): Self- assembly of an octanuclear high-spin Fe(II) molecular cage, *Aust. J. Chem*., in press.
2. Florian Reichel, Jack K. Clegg, Karsten Gloe, Kerstin Gloe, Jan J. Weigand, Jason K. Reynolds, Chun-Guang Li, Janice R. Aldrich-Wright, Cameron J. Kepert, Leonard F. Lindoy, Hong-Chang Yao and Feng Li (2014): Self-Assembly of an Imidazolate-Bridged FeIII/CuII Heterometallic Cage, *Inorg. Chem.*, 688-690.
3. Jack K. Clegg, Feng Li, Katrina A. Jolliffe, George V. Meehan and Leonard F. Lindoy, (**2011**) An expanded neutral M4L6 cage that encapsulates four tetrahydrofuran molecules. *Chem.Commun.*, 6042-6044.

Project Aims

1. To employ directed assembly procedures, hierarchical or stepwise syntheses and template controls for constructing innovative finite nanometre-scale cages.

2. To observe and study spin-switching behaviours by variation of both the steric nature of the ligand type employed and the applied external stimulus (e.g., temperature and light) as well as to explore the structural and electronic features that impart electronic communication in such systems.

3. To explore the potential of new delivery systems based on spin transition coordination cages which incorporate readily variable functional groups (e.g., unsaturated metal sites to increase loading capacity) and tuneable pores sizes.

Project Methods

Coordination functional groups with rigid bitopic spacers or (semi-)rigid tritopic spacers will be used as the bridging ligands for the construction of the target self-assembly homonuclear metallo-supramolecular nano-cages (Refs 1 and 3 in the project description). In addition to the design of heteronuclear cages based on tripodal metalloligands, the approach allows for the construction of predictable architectures involving operation of a cooperative effect (Ref 2 in the project description).

The load-and-release process in drug delivery will be investigated using UV-vis and fluorescence spectroscopy, ITC (isothermal titration calorimetry) titration and diffusion NMR. The drug loads will be quantified using a combination of thermal analysis methods (TGA and DSC). HPLC will be used to determine both the quantity and chemical purity of the loaded drug. FTIR and mass spectrometry will not only be used to verify the chemical composition of the loaded drug but also to monitor the in situ loading process. Cell line studies will be investigated to distinguish the difference between loaded drug and released form in cell cytotoxicity properties. X-ray single and powder diffraction (XRPD) studies will provide information on binding structure and stoichiometry the loaded drug and SEM will provide the sample's surface topography.

Overall, the programme as outlined above represents a continuing study in the field of coordination cages in the CIs' groups, in view of their experience across organic synthesis, metal-based anti-cancer drug, host-guest studies including DNA binding, cell line studies, metallosupramolecular chemistry and magnetism is well placed to be highly successful.[1]

1. Benjamin W. Harper, Feng Li, Rhys Beard, K. Benjamin Garbutcheon-Singh, Neville S. Ng, and Janice R. Aldrich-Wright (**2013**): "Metal complexes and nucleic acid interactions" in Supramolecular Systems in Biomedical Fields, Chapter 9, Editor H.-J. Schneider, RSC Publishing. pp. 260-99.

Opportunities for Skill Development

The research programme will provide significant training opportunities for undergraduate students in pursuing for Honours or HDR studies in a wide range of skills encompassing supramolecular and nanomaterials synthesis, compound and device characterisation and physical measurements using a variety of techniques which are required for employment in Australia's growing new advanced materials and nanotechnology industries. As a continuing project, all results obtained by students will be submitted for publication in appropriate high-quality journals of international repute such as those the Nature Publishing Group, Science, the Royal Society of Chemistry and the American Chemical Society, which will also increase the reputation of both the School and UWS. In addition, this project will offer the great opportunities to establish strategic collaborations with other leading researchers who have complementary strengths across industry, research institutions and other disciplines. Based on our previous publications in 2014, this research project can be easy to complete within 8 weeks for at least one publication in the respect with our experience of supervision.

Students are required to have the following skills to apply

The 3rd year students are required to conduct this project, especially for the students who have completed science research project or advanced science research project in chemistry or biochemistry and are ready for Honours or HDR studies.

Project Title 55: Imagery Ability of Healthy Adults.

Supervisory team: A/Prof Karen Liu

Contact information for Supervisor:
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Project Description

Mental imagery is a mental process of perceiving an object, event, action, or scene when the relevant item is not actually present (Thomas, 2009). It involves the individual actively imagining a specific item related to either one or more of the five senses, such as visual, auditory, kinesthetic, olfactory and gustatory. Previous research in cognitive psychology and neuroscience provides evidence that, when viewing mental images, the brain maintains the images as image-like wholes (Kosslyn, 2014). This is a different concept from the traditional theory on memory. With this foundation, researchers are trying to expand the knowledge in this area such as differentiating the types of imagery and the ways of storing and manipulating imageries in the human brain neurologically.

Mental imagery has been used widely to promote performance in athletes. The principal supervisor of the project (A/Prof Karen Liu) has been studying the use of mental imagery in practical clinical situations, relearning lost skills to promote functional recovery after stroke (Kho, Liu, & Chung, 2013; Liu, Chan, Lee, & Hui-Chan, 2004a, 2004b; Liu et al., 2009). The use of mental imagery is expanding from learning relaxation, acquiring a new skill, to practical use in sports and health care settings (Rogers, 2006; Taktek, Zinsser, & St-John, 2008).

In view of its wide and potential application in sports and clinical sciences, an emerging and important area of research in the School of Science and Health, it is important to understand the imagery ability and the difference among healthy young adults, middle-aged adults and older adults. With this increase in understanding of the imagery ability, further studies can be completed to explore the application of mental imagery in different applications; as well as to understand the imagery ability of people with various clinical conditions and thus facilitate its application in healthcare settings.

Project Aims

1. To investigate the imagery ability for healthy young, middle-aged and older adults.
2. To develop the imagery profile for healthy young, middle-aged and older adults.

Project Methods

<u>Study design</u>
The project will adopt a cross sectional design in which recruited participants will undergo testing in one session.

Participants

Three groups of participants will be recruited: (i) young adults (aged 18 to 35); (ii) middle-aged adults (aged 36 to 55); and (iii) older adults (aged at or above 56) (Petry, 2002). Thirty participants will be recruited for each age group.

All participants will be required to fulfill the following selection criteria:

a. Are healthy without any neurological conditions and musculo-skeletal limitations;
b. Have intact attention, comprehension, and short-term memory functions as screened by the Cognistat (a general cognitive assessment);

Participants will be excluded from the study if they have:

a. Been diagnosed with any neurological conditions;
b. Knee extension dysfunction or recent knee surgery (This is due to their need to be able to complete the Mental Chronometry Test).

Assessment used

This study will consist of the Mental Chronometry Test (a time dependent imagery test in which participants will practice mental rehearsal of a knee extension in sitting position) and a series of questionnaires measuring their movement and visual imagery. They include the Movement Imagery Questionnaire-Chinese version (MIQ-C); the Vividness of Visual Imagery Questionnaire-Chinese version (VVIQ-C); Self-rating of vividness; the Vividness of Motor Imagery Questionnaire (VMIQ); the Kinesthetic and Visual Imagery Questionnaire-20 (KVIQ-20).

Procedures

The participants will be given the Foot Preference Questionnaire (Chapman, Chapman, & Allen, 1987) to identify their dominant foot side, and then complete the questionnaires: MIQ-C, VVIQ-C, VMIQ, and KVIQ-20. The mental chronometry test will be carried out after the four questionnaires under three time limitations. These will be 15 seconds, 25 seconds, and 45 seconds. The participants will perform the imagined knee extension action in sitting position. Before the testing session, participants will be instructed on how to produce the motor mental imagery and visual mental imagery.

Data analysis

Descriptive statistics will be used to report the results. Participants' mental imagery ability and profile as reflected by the various assessments will also be reported. The relationship among the movement and visual imagery will be tested using correlational statistics. Comparison of the imagery ability among the three participants groups will be tested using multivariate analysis of variance (MANOVA).

Student Time line for the work

Week 1: Become familiar with the project; search for relevant literature; commence participant recruitment
Weeks 2-5: Continue participant recruitment; collect data from participants
Week 6: Analyse data

Opportunities for Skill Development

Skill development
The student will learn:

- the research design of a cross sectional study,
- the procedure of getting consent and engaging participants in research study,
- the input of data into a statistical package, analysis of the data set using basic quantitative analysis methods and its interpretation,
- to interact with people of different ages including young, middle-aged and older adults.
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These skills are necessary for his/her further development in research (e.g. honours or HDR study) and health care service provision.

Research environment
The student will receive daily supervision and guidance from the supervisors. The student will be co-located with other occupational therapy HDR and honours students in building 21. Fortnightly meetings with this group will be held to share ideas and their research work. The student in this programme will also gain peer support during the process.

Other outcomes
Based on the findings in this project, the student is expected to prepare a manuscript for journal submission under the guidance of the supervisors. He/she will be the author of the manuscript. The results will also form part of a larger study investigating the imagery ability of people with clinical conditions including stroke, Parkinson's disease and dementia. The student will assist in and learn the process in writing up a research proposal.

Students are required to have the following skills to apply

There is no specific skill required. Students in their second or third year of their study who are interested in clinical research are welcome to join the project.