UNSW
THE UNIVERSITY OF NEW SOUTH WALES

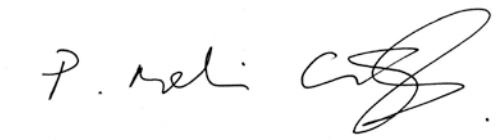
2010 SCIENCE POSTGRADUATE RESEARCH COMPETITION

2010 UNSW
Faculty of Science
Postgraduate Research Competition

It is my pleasure to welcome all participants and supporters to the inaugural Faculty of Science Postgraduate Research Competition. This event has been organised to recognise the outstanding research that postgraduate research students undertake within the Faculty of Science. The event includes a poster presentation plus a speedy 1 minute 'taster' of the work.

The Faculty recognises that the work of its research students is a fundamental part of the high standing of the Faculty's research. I encourage you to look at the posters, listen to the presentations and marvel at the breadth of research that is conducted in the Faculty of Science. Please also interact with the students and enjoy the enthusiasm which they show for their work.

Afterwards, I am sure you will agree with me that we are fortunate to be working with these future leaders of science and technology in academia, industry and the broader community.



Professor Merlin Crossley
Dean
Faculty of Science

PROGRAM

THE UNIVERSITY OF NEW SOUTH WALES FACULTY OF SCIENCE

2010 POSTGRADUATE RESEARCH COMPETITION

Thursday 19 August, Leighton Hall,
The John Niland Scientia Building

2:00pm	Posters available for viewing
2:50pm	Professor Mark Hoffman, Associate Dean Research Opening Remarks
	1 minute presentations commence
3:00pm	Cutting-Edge Discovery Science Living Well and Ageing Well
4:00pm	Energy & Materials Technologies Climate, Environment and Sustainability
5:00pm	Science and Society
6:00pm	Presentation Ceremony commences Professor Mark Hoffman, Associate Dean Research Opening remarks
	Professor Gavan M^{c}Nally, Associate Dean Research Training Announcement of winners
	Professor Merlin Crossley, Dean, Faculty of Science Presentation of awards
7:00pm	Event closes

Light refreshments will be served from 6:00pm to 7:00pm during the poster presentation and judging

CUTTING-EDGE DISCOVERY SCIENCE

CDS

EVOLUTION OF MALE AND FEMALE GENITALIA UNDER DIFFERENTIAL LIFE HISTORY AND SEXUAL SELECTION REGIMES

CDS 1

Luis Cayetano and Dr Russell Bonduriansky
School of Biological, Earth & Environmental Sciences
The University of New South Wales

Abstract
As the site of direct contact between the sexes during sperm transfer, genitalia are expected to experience strong sex-specific selection and mediate sexual conflict. Yet, the empirical evidence bearing on these predictions is equivocal. The genitalia of many insects contain armatures assumed to reflect sexual conflict, but this assumption is largely based on indirect evidence, and few studies have investigated the coevolution of genital armatures in both sexes. I tested for effects of differential regimes of sexual selection (polygamy vs. monogamy) and life history (early vs. late oviposition) and their interaction on multiple genital structures of male and female Callosobruchus maculatus beetles. After 18-21 generations of selection, a significant interaction was detected between life history and sexual selection regimes for two non-intromittent male genital appendages, which responded through the evolution of mean relative trait size. One male intromittent trait -- the length of aedeagal spines -- evolved a significantly shallower static allometry in monogamy lines, compared with polygamy lines. No significant responses were observed for any female trait. These results show that genital traits can respond rapidly and in diverse ways to selection and provide the most direct evidence yet available that genital structures play a role in sexual conflict.

"SPINTRONICS" ADDING NEW DIMENSION TO COMPUTING AND INFORMATION TECHNOLOGY

CDS 2

Mohammad Al Assadi and Associate Professor Sean Li
Materials Science & Engineering
The University of New South Wales

Abstract
Recent advances in new materials engineering hold the promise of surmounting the fundamental limits of silicon technology by exploiting the spin degree of freedom in semiconductors to realize spintronic devices with enhanced functionality, higher speed and reduced power consumption in the near future. It is believed that spintronic devices designed for quantum computers and quantum communication will dominate the information technology in the 21st century. Our research at the School of Materials Science and Engineering aims at (1) a better understanding the basic physical behavior of the electrons in spintronics devices both by theoretical and experimental means which with no doubt will promote practical applications; (2) clarification of the critical role of materials engineering and nanotechnology that allows us fabricating the commercial spintronic devices and finally (3) achieving a novel, state-of-are and high-performance materials for the application of Spintronic devices. Such devices are to revolutionize telecommunication, computing and daily life. Current conventional electronic industry has market worth of US$ 1000bn per year. In the next few years spintronics will be on par with electronics. The developed technologies in our program will be commercialized through transferring the patents to the semiconductor industries.

AGEING AND CONDITION: HOW TO MAXIMIZE FITNESS WHEN YOU'RE SMALL, HUNGRY AND LONELY

CDS 3

Margo Adler and Russell Bonduriansky
School of Biological, Earth & Environmental Sciences
The University of New South Wales

Abstract
Theory on the evolution of ageing predicts that organisms will maximize fitness by scheduling resource use over the lifetime to optimally balance reproduction and longevity. Ageing and lifespan are known to be highly plastic traits, but the influences of two key environmental parameters -- social environment and resource abundance -- are rarely considered simultaneously in studies of ageing. This could be particularly important when males compete for females or when females resist males, as resources devoted to these activities will likely trade off with survival. We manipulated developmental diet (condition) and sex ratio in the neriid fly, Telostylinus angusticollis, and quantified total adult lifespan and rate of somatic deterioration. We found that both males and females housed individually live longer than flies housed in groups, suggesting a cost to social interaction. These costs were sex-specific: For males, interacting with other males resulted in greater lifespan reductions than interacting with females, while for females, sex ratio was unexpectedly found to have no effect on lifespan. In addition, flies in high condition were shown to live longer than flies in poor condition, but also deteriorated more rapidly in the same amount of time, providing evidence for trade-offs in resource allocation.

INTERACTIONS BETWEEN FEAR AND DISGUST IN CONTAMINATION BASED OBSESSIVE COMPULSIVE DISORDER (C-OCD)

CDS 4

Joshua Broderick and Dr Jessica Grisham
School of Psychology
The University of New South Wales

Abstract
Recent evidence has implicated the emotion of disgust - particularly sensitivity to experiencing it - in the maintenance and etiology of a number of anxiety disorders, including contamination-based OCD (C-OCD). The current study investigated the habituation of disgust and (fear) in an analogue sample of participants with both high and low C-OCD symptom severity (assessed via the Padua inventory-revised). Importantly, recent research into the habituation of disgust and fear in C-OCD has only been conducted using self report measures. The current study aimed to improve upon this research by using physiological measurements concurrently with self report. We exposed participants to a standardised set of disgust eliciting images (blood injury or body waste). During image presentations participants made subjective ratings of fear and disgust. In addition measurements of facial EMG, skin conductance and heart rate were recorded. Results suggest that fear and disgust do interact in a significant manner in both groups and that disgust sensitivity is higher in high C-OCD symptom groups. Indeed the high symptom severity C-OCD group reported more fear and disgust to all images. Physiological measures showed some correlation with subjective ratings. These findings have important implications for the clinical treatment of C-OCD.

A COMPARISON OF NEURONAL AND BEHAVIOURAL PERFORMANCE IN RAT WHISKER SYSTEM

CDS 5

Mehdi Adibi and Ehsan Arabzadeh
School of Psychology
The University of New South Wales

Abstract
Finding the link between neuronal activity and behaviour is a primary goal of systems neuroscience. Here we use the rat whisker touch as a model system to investigate the correlation between the response of individual neurons and the behaviour of rats in a sensory discrimination task. Whisker touch is structurally well characterized and represents the major channel through which rodents collect information about the environment.

We first recorded the activity of neurons (n=235) in the whisker area of the rat somatosensory cortex in anaesthetised rats while applying vibro-tactile stimuli of varying intensities to the whiskers. All neurons showed a characteristic sigmoid input/output function. We further quantified the performance of individual neurons for stimulus detection and for discrimination across different stimuli with identical intensity differences. For near threshold stimuli, the neuronal discrimination performance surpassed the detection performance (89% of the neurons).

In the second stage of the Experiment, four rats were trained to select the higher intensity stimulus between two vibrations applied to their whiskers. Similar to neuronal results, the rats' performance was better for the discrimination task compared to the detection task. Importantly, the behavioural performance followed the same trend as that of the population of individual neuron.

HEAVYWEIGHT HYDRIDES

CDS 6

Samantha Furfari and Dr Marcus L. Cole
School of Chemistry
The University of New South Wales

Abstract
The chemistry of boron and aluminium trihydrides is well established, with many applications in organic and inorganic chemistry. The focus on the lighter elements group 13 elements is due to their superior air and thermal stability. We aim to develop the chemistry of the heavier group 13 hydrides (Ga, In or Tl) by applying the stabilisation techniques that have been successful for the lighter group 13 elements such that their full their full synthetic ability may be explored. One stabilisation technique is the partial replacement of hydrides for halides to strengthen the remaining M-H bond. Another technique is the use of anionic donor ligands to sterically shield the metal hydride.

Another avenue of investigation is the chemistry of halogenated N-heterocyclic carbenes (NHCs). These air stable carbenes have potential in transition metal and organocatalysis. However, their use in the wider scientific community has been sparse. We have sought to redress this by investigating their donor strength as well as establishing their d-block chemistry.

DISCOVERY OF NEW HIGH-PERFORMANCE ENVIRONMENTALLY-FRIENDLY PIEZOELECTRIC MATERIALS

CDS 7

Ching-Jung Cheng and Valanoor Nagarajan
School of Materials Science & Engineering
The University of New South Wales

Abstract
Lead (Pb)-based piezoelectric oxides belong to a special class of materials with ability to generate electricity under mechanical stress and vice versa, and are the heart of electronic, telecommunication and aerospace applications. While the technology is well-established, lead is a potent neurotoxin that poses a serious threat to human health, especially children, and to the environment. Driven by environmental regulations and concerns worldwide, there is a strong impetus to seek new high-performance “green” piezoelectric materials that are Pb-free and hence toxicity-free. During my PhD program, a new Pb-free Sm-substituted BiFeO3 compound has been discovered with exceptional electromechanical and functional properties comparable to traditional Pb-based piezoelectrics. Furthermore, the complex interplay between structural transitions and the chemical origins of the enhanced properties have been unraveled by a wide variety of state-of-the-art techniques. In particular, the world highest resolution transmission electron microscope has been employed to provide the first glimpse between miniaturized phases and their interfaces at atomic scale. It is anticipated that this this newly discovered material not only may open the door for designing a plethora of novel multifunctional technologies that rely upon the piezoelectric effect but also undoubtedly benefit society tremendously.

MECHANICS OF BITING IN GREAT WHITE AND GREY NURSE SHARKS

CDS 8

Toni Ferrara and Stephen Wroe
Biological, Earth & Environmental Sciences
The University of New South Wales

Abstract
Although a strong correlation between jaw mechanics and diet has been demonstrated in bony fishes, such relationships remain largely untested in cartilaginous fishes. Hence, tooth shape is regarded as a primary predictor of feeding behaviour in sharks. Here I apply Finite Element Analysis (FEA) to examine form and function in the jaws of two threatened shark species, the great white and grey-nurse. Results show that the jaws of grey-nurse and great white sharks are adapted for rapid closure and generation of maximum bite force respectively, and that these differences are consistent with diet and dentition. The data also reveals how a specialized jaw muscle arrangement allows sharks to maintain high bite forces at wide gapes. This key innovation may help elucidate the success of chondrichthyan feeding mechanisms. Finally, the data suggest that the jaws of sub-adult great whites are mechanically vulnerable when handling large prey. In addition to ontogenetic changes in dentition, further mineralisation of the jaws may be required to effectively feed on marine mammals. This study is the first comparative FEA of the jaws for any fish species. These results highlight the potential of FEA for testing previously intractable questions regarding feeding mechanisms in sharks and other vertebrates.

ASSESSING COMMUNITY DIVERSITY OF SPONGE-ASSOCIATED MICROORGANISMS WITH METAGENOMIC SHOT-GUN SEQUENCING DATA

CDS 9

Lu (Chris) Fan and Torsten Thomas
School of Biotechnology & Biomolecular Sciences
The University of New South Wales

Abstract
Sponges harbour dense communities of bacterial and archaean symbionts, which come from diverse and often novel phylogenetic lineages. Conventional molecular investigations of these (and other) microbial communities is -up to now- mostly performed by amplifying the 16S rRNA genes within the community with “universal” primers. However it is also well-known that those primers and the PCR itself can cause systematic bias and that chimeric products are often formed during amplification. This means that an incomplete or skewed picture of community composition is often obtained. Pyrosequencing of random (shot-gun) DNA fragments derived directly from the environment provides an opportunity for an unbiased assessment of the microbial community composition. However, the accuracy and resolution of a phylogenetic analysis based on shot-gun reads is limited by the short read-length (e.g. 100 - 400 nt) and the random nature of the fragments over the entire length of the 16S rRNA gene. In this study, we extracted the 16S rRNA gene sequences from the metagenomic shot-gun pyrosequencing data of microbial communities from 5 Australian sponges and sea water. We developed a “nucleotide number”-based method to obtain operational taxonomic units (OTUs) from metagenomic shot-gun datasets and improved the estimation of the community diversity.

EVIDENCE FOR SPACE-TIME VARIATION IN THE FINE STRUCTURE CONSTANT

CDS 10

Julian King and Professor John Webb
School of Physics
The University of New South Wales

Abstract
Modern physical theories have enormous predictive power. Yet they contain a number of fundamental constants which cannot at present be derived, and therefore must be measured. The hugely successful Standard Model requires that the values of these constants are the same throughout time and space. Attempts to unite the Standard Model and General Relativity, the two pillars of twentieth century physics, have not yielded a successor. However, most paths towards uniting these two theories produce predictions that the fundamental constants of nature vary with time and space. Previous observations of quasar absorption lines obtained with the Keck telescope have found evidence that the fine structure constant, which determines the strength of electromagnetism, was different billions of years ago. We have performed a complimentary analysis using the Very Large Telescope (VLT). When the new VLT data are combined with the previous Keck sample, a beautiful consistency emerges, supporting the time-dependence of the fine structure constant seen with the Keck telescope, and at the same time revealing a statistically significant signal for a dipole-type spatial dependence. To my knowledge, nothing like this has been observed in physics before and, if correct, will require new physics at the most fundamental level.

THE SUPERINFECTIVE PROPHAGE IN PSEUDOMONAS AERUGINOSA BIOFILM DRIVES BACTERIAL ADAPTATION

CDS 11

Janice Hui, Scott Rice and Staffan Kjelleberg
School of Biotechnology & Biomolecular Sciences
The University of New South Wales

Abstract
Prophage sequences have been identified in most sequenced bacterial genomes and thus are likely to contribute significantly to the genetic repertoire of bacteria. However, the effects of prophage and accessory genes on the host are yet to be fully elucidated. A recent study by Rice et al. has shown that a prophage of Pseudomonas aeruginosa plays a key role in maturation, cell death, dispersal and variant formation during biofilm development, an important mechanism for bacterial survival in the environment (ISME J. 2009; 3:271-282). Further, these effects are manifested in the biofilm when the phage becomes superinfective. Biofilm flow cells were employed to determine the development of biofilm structures between P. aeruginosa variants that constitutively produce superinfective phage and the wild-type. Biofilms of the constitutively superinfective variants did not undergo microcolony formation and displayed early cell death during the biofilm developmental process. Sequence analysis of the superinfective phage indicated that super infection is linked to either single nucleotide polymorphism in a gene with homology to the repressor C gene of the Enterobacteria phage P2 or is the result of large deletions of the Pf4 phage genome. Given the pronounced effects of the prophage on the life cycle of P. aeruginosa biofilms, elucidation of the host-phage interaction may be key to understanding biofilm formation and adaption in the environment.

RESHAPING THE CORNEA TO CORRECT ASTIGMATISM

CDS 12

Vinod Maseedupally and Associate Professor Helen Swarbrick
School of Optometry & Vision Science
The University of New South Wales

Abstract
Orthokeratology (OK) is a clinical contact lens-based technique in which specially designed rigid lenses reshape the cornea during overnight wear to temporarily correct refractive error after lens removal. During OK for myopia correction, the refractive outcome arises from lens-induced central corneal flattening and mid-peripheral steepening, which collectively result in reduced corneal power and a more spherical or oblate-shaped cornea. However the overall changes in corneal shape during OK are more complex, because normal corneal shape may vary by meridian or hemi-meridian. No previous studies have investigated differential effects of OK on corneal meridians, or the potential for correction of astigmatism using OK. This project aims to provide strategies for developing novel OK lens designs to correct astigmatic refractive error. The project will be conducted in three phases. In Phase I, we have investigated relationships between corneal shape and eyelid geometry in three different ethnic groups. In Phase II, we will fit standard spherical OK lenses on myopic eyes with corneal astigmatism, and study changes in different corneal meridians after overnight lens wear. In Phase III, based on results from previous phases, we intend to develop a new design of OK lens that reshapes the cornea to correct astigmatism.

GONE BUT NOT FORGOTTEN: PERSISTING NEURAL ACTIVITY IN THE AMYGDALA REFLECTS THE EXISTENCE OF A FORGOTTEN FEAR MEMORY

CDS 13

Stella Li and Professor Rick Richardson
School of Psychology
The University of New South Wales

Abstract
Memory impairments are becoming increasingly prevalent in both the aged population as well as general society. Despite this, we have a relatively poor understanding of the neural and molecular processes underlying forgetting. The current experiment used both behavioural and immunohistochemical techniques to examine learning and forgetting in the rat. Rats were trained to fear a conditioned stimulus such that they would exhibit either excellent memory or substantial forgetting at a later test. Another group of rats that were not trained acted as controls. Following test, the amount of neuronal activity in the amygdala was measured in all rats. Excitingly, the results showed, for the first time, that neuronal activation in the amygdala persisted even when animals exhibited pronounced forgetting. Specifically, both trained groups showed significantly greater amygdala activity compared to animals that were never trained. This neural reflection of a persisting memory can be thought of as a signature of the previous learning experience. These results also suggest that, at least in some circumstances, forgetting is not caused by memory decay or erasure, and have exciting implications for our understanding of memory (for example, the possibility of developing treatments to access seemingly forgotten memories).

DIABETOGENIC CD4+ T CELLS COMPRISE A NOVEL T HELPER SUBSET THAT CO-EXPRESS INTERLEUKIN-21 AND THE CHEMOKINE RECEPTOR CCR9

CDS 14

Helen McGuire and Cecile King
Biotechnology & Biomolecular Sciences
The University of New South Wales

Abstract
Studies collectively demonstrate that both CD4+ and CD8+ T cells are necessary for the development of type-1 diabetes. Although CD4+ T helper cells comprise a substantial part of the inflammatory lesion in the pancreatic islets of NOD mice, they remain largely uncharacterized. This study reveals a previously undescribed population of CD4+ T helper cells that are the sole source of IL-21 in the autoimmune infiltrates of the pancreas in the NOD mouse. The IL-21+ cells distinctly co-expressed the gut-homing chemokine receptor CCR9, and whilst they expressed T-bet, they lacked the ability to produce either IFN- γ or IL-17, resembling recently described extrafollicular T helper cells. Neutralization of IL-21 was used to pin-point the influence of these cells on disease pathogenesis: Treatment disrupted the islet lesion, which was marked by a rapid depletion of activated CD8+ T cells. Both the production of IL-21 by CD4+ T cells and receptiveness to IL-21 by CD8+ T cells were found to be necessary for the induction of diabetes. These studies reveal a network in which IL-21 produced by CD4+ T cells provides a soluble helper signal that ensures the survival of autoreactive CD8+ T cells in non-lymphoid tissues.

METAGENOMIC SCREENING OF COLD ADAPTED SUBTILASE FROM COLD ENVIRONMENT

CDS 15

Suhaila Mohd Omar and Ricardo Cavicchioli
School of Biotechnology & Biomolecular Sciences
The University of New South Wales

Abstract
Serine protease-subtilisin covers approximately 40% of the industrial enzyme market which amounted more than $300 million annually. The demand for next-generation protease is more into its new properties such as high performance at cold temperature or high saline condition. The advance in metagenomic has brought a new chapter in extremozyme discovery as more novel enzyme could be discovered from various extreme environments without tedious cultivation effort. A metagenomic study of Ace Lake, Antarctica, has enabled both sequence-based and functional-based screening of enzymes from this environment. Subtilase sequence-based screening of the metagenomes using profile Hidden Markov Model (HMM) of peptidase S8 (PF00082) (HMMER 3.0) showed high presence of this enzyme in Ace Lake environment. Functional based screening of clones that harbour the subtilase gene is carried out by agar-assay (2% skim milk) to confirm the sequence-based findings. Clones that show proteolytic activity will be subcloned and overexpressed in E.coli BL21 (DE3). The proteins will be purified and characterized for the biochemical properties, protease activity, substrate specificity and inhibitory effect of various chemical reagents.

THE ORIGINS OF PSYCHOPATHY: INTEGRATION AND INTERACTION

CDS 16

Caroline Moul and Professor Mark Dadds
School of Psychology
The University of New South Wales

Abstract
While the treatment of children with conduct problems has dramatically progressed over recent years, there remains a fraction of this population that persistently proves hard to treat. This same group of children typically develop serious conduct problems that persist into adult life and, as such, are responsible for large strains on public and health services. It has been argued that this sub-group of conduct disordered children may be characterised by high levels of callous-unemotional traits. Callous-unemotional traits can be considered the precursors to the personality factor of adult psychopathy and are similarly characterised by low levels of empathy, a lack of shame and guilt and a shallow affect. This research posits a new causal hypothesis for the development of callous-unemotional traits that integrates behavioural and neurological findings from adult, child and animal literature. At its core is the suggestion that variations in specific neurochemicals interact to result in differential activation of sub-sections of the amygdala which leads to measurable effects in processes such as human learning and fear recognition. This research utilises personality, behavioural and neurochemical measures from a large clinical sample in addition to a novel computer task and animal experiments to thoroughly test this hypothesis.

MODELLING AMYLOID-BETA AGGREGATION IN SACCHAROMYCES CEREVISIAE

CDS 17

Suresh Nair and Professor Ian W. Dawes
School of Biotechnology & Biomolecular Sciences
The University of New South Wales

Abstract
Alzheimer's disease is the leading cause of dementia in individuals over 65 years of age; and the risk of developing Alzheimer's disease increases steadily with age. A major neuropathological feature of this disease is the presence of amyloid-beta (Aβ) plaques, which are primarily composed of aggregates of Aβ peptides generated via amyloidogenic processing of the amyloid precursor protein. The two major isoforms of amyloid beta are abeta Aβ40 and Aβ42, of which the latter is highly prone to aggregation and is more neurotoxic. It was recently hypothesised that increased presence and aggregation of intracellular Aβ42 peptides may play a role in the progression of Alzheimer's disease. In our study, we have expressed Aβ42 fused to GFP (Aβ42-GFP) in each of the mutants of the Saccharomyces cerevisiae genome-wide deletion library. This approach has identified on a genome-wide level the proteins and cellular processes that affect intracellular Aβ42-GFP aggregation. In addition, sub-cellular localisation of Aβ42-GFP was also identified in these mutants. The data generated in this study may have important implications for our understanding of cellular mechanisms that affect intracellular Aβ42 aggregation and the factors affecting the disease progression of Alzheimer's disease.

A NOVEL CONTROL POINT IN CHOLESTEROL BIOSYNTHESIS

CDS 18

Julian Stevenson and Associate Professor Andrew Brown
School of Biotechnology & Biomolecular Sciences
The University of New South Wales

Abstract
Cholesterol is an essential molecule in humans, but its levels must be exquisitely controlled, achieved partly through regulation of its biosynthesis. Study has focussed on 3-hydroxy-3-methyl-glutaryl-coenzyme A reductase (HMGCR), billed as the 'rate-limiting' enzyme in the pathway and target of the blockbuster statin class of drugs. In contrast, little is known about the more than twenty other enzymes involved in cholesterol synthesis, thought to be relatively unimportant for maintenance of cholesterol homeostasis. Surprisingly, we observed that cholesterol treatment of hamster cells caused squalene to accumulate, indicating that the downstream enzyme squalene monooxygenase (SM) may serve as a 'rate-limiting' enzyme beyond HMGCR. This accumulation was also seen in mutant cells lacking sterol regulated transcription, implying that cholesterol regulates SM post-transcriptionally. Indeed, we found that SM protein was degraded within hours of cholesterol addition. Proteasomal inhibition blocked this degradation and reversed the squalene accumulation, suggesting that the cholesterol-induced degradation of SM is a flux control point in cholesterol synthesis. Regulated degradation required the N-terminal domain of SM conserved in higher organisms, but not required for activity. This region also conferred cholesterol-regulated turnover on heterologous fusion proteins. Therefore, we have identified an important novel control point in the feedback regulation of cholesterol biosynthesis.

NOVEL MOLECULAR ARCHITECTURES DERIVED FROM ACTIVATED INDOLES

CDS 19

Kasey Wood and Associate Professor Naresh Kumar
School of Chemistry
The University of New South Wales

Abstract
Indole alkaloids are found extensively throughout terrestrial and aquatic natural products. Well known examples include the amino acid tryptohan which is essential to the human diet, the neurotransmitter serotonin and the hallucinogen lysergic acid diethylamide (LSD).

These organic compounds display a wide range of physiological activities which, when coupled to their incredible structural diversity, makes them highly attractive to the pharmaceutical industry. This is highlighted by indole alkaloids forming the basis of beta-blockers, anti-inflammatory and cancer chemotheraphy drugs sold on the market.

Synthetically, it can be difficult to produce these natural products or related structures due to one particular position of the indole showing no propensity to undergo a chemical reaction. Through introduction of two “activating” methoxy groups to the indole we were able to successfully induce a chemical reaction at this “inactive” position. This subsequently allowed the development of novel, efficient and versatile routes to several key structures related to a range of biologically active indole natural products.

PERCEPTUAL LEARNING: TRAINING THE BRAIN TO SEE BETTER

CDS 20

Nisha Yeotikar and Catherine M Suttle
School of Optometry & Vision Science
The University of New South Wales

Abstract
Perceptual learning (PL) is a relatively permanent improvement in performing perceptual tasks (e.g. visual, auditory or tactile) as a result of practice. In the visual modality, the brain (perceptual system) is trained to use the fine details of vision. This process actively stimulates the brain and can lead to considerable visual improvement, interestingly even after the normal developmental period of vision. Over the past two decades, PL has emerged as a potential vision therapy for disorders such as ‘amblyopia’ (lazy eye), in which one eye has reduced vision due to poor visual development during childhood and which is generally considered untreatable in adults. Amblyopia can restrict the affected adults from entering certain occupations. Therefore, the possibility of using PL as a treatment for adults with amblyopia is exciting and promising.

Our research investigates the impact of PL on contrast sensitivity (the ability to discriminate grey levels) in normally-sighted adults. We aim to optimise visual stimulation for PL therapy in order to obtain maximum improvement in the normal visual system. A follow-up study will investigate the efficacy of those stimuli for vision therapy in adults with amblyopia. This research will have implications for the future clinical management of amblyopia in adulthood.

CONTACT LENS CASE HYGIENE PRACTICES

CDS 21

Yvonne Wu, Professor Fiona Stapleton, Dr Hua Zhu and Professor Mark Willcox
School of Optometry & Vision Science
The University of New South Wales

Abstract

PURPOSE

There are 125 million contact lens users worldwide. Epidemiological studies have confirmed that poor contact lens case hygiene may cause microbial keratitis, a sight-threatening condition. However, there are limited data on how to clean contact lens cases. This study experimentally evaluated the effectiveness of various cleaning procedures in removing biofilm from contact lens cases, hoping to provide lens case hygiene guidelines for lens wearers, practitioners and the industry.

METHODS

Bacterial biofilms were formed on lens cases. Each lens case was then subjected to one of the following cleaning methods: rinsing with disinfecting solution, rubbing with fingers, wiping with tissues, air-drying for 6 hours, and recapping lids for 6 hours. The residual bacteria after each cleaning procedure was quantified. The most effective cleaning procedures that were then tested sequentially.

RESULTS

Air-drying and recapping the lids had no effect in removing biofilm ($p>0.9$). Rinsing with solution elicited a marginal anti-bacterial action. Rubbing lens cases and wiping with tissues were the most efficient, and these two cleaning methods combined provided the optimum results ($p<0.001$).

CONCLUSION

Applying a shearing-force (rubbing and wiping) to lens cases is the most effective method in removing biofilm. Recapping the lens case lids or air-drying alone should be discouraged.

AN INSIGHT INTO DEMYSTIFYING THE ESOTERIC DOTS

CDS 22

Fehmida Kanodarwala and Associate Professor John A. Stride
School of Chemistry
The University of New South Wales

Abstract
Quantum dots (QDs) are nanocrystalline semiconductors which exhibit extraordinary quantum confinement phenomenon [1] - which provides them with distinctly different optical, electronic, and magnetic properties from their bulk counterparts. These properties have enabled their application to many different technological areas including biological labelling and diagnostics [2], light-emitting diodes [3] and electroluminescent devices, photovoltaic devices, lasers, and even as single-electron transistors. QDs have been fabricated employing a number of synthetic schemes ranging from molecular beam epitaxy [4] to wet-chemical colloidal synthesis. Our aim is to synthesis high-quality CdSe nanocrystals through benchtop colloidal synthesis whilst analysing the effects of varying the reaction temperature, solvent and reaction time on the size, shape and crystallinity of the quantum dots. The changes in reaction time induced the transition of the crystallite phases from cubic zinc-blende to hexagonal wurtzite and back again to cubic phase. We believe this is due to the rapid growth along the {111} facets of the cubic unit cell and then finally the other facets 'catch-up' to result in a particle with cubic symmetry once again. The crystal phases were identified by employing powder X-ray diffraction, the results of which were in conformity with those deduced through high resolution transmission electron microscopy.

References
[1] Dabbousi, B. O. et al. J. Phys. Chem. B 101, 9463 (1997).
[2] Dubertret et al.,Science, Vol. 298, Nov. 2002
[3] Lee, Chih-Wen; Yang, et al., J. Nanoscience and Nanotech., Vol. 9, No. 3, March 2009 , pp. 2076-2080.
[4] P. Petroff et al. Physics Today, May 2001

LIVING WELL AND AGEING WELL

LWAW

WORKING MEMORY-RELATED BRAIN ACTIVITY PREDICTS TREATMENT OUTCOME IN POSTTRAUMATIC STRESS DISORDER

LWAW 1

Adrian Allen and Professor Richard Bryant
School of Psychology
The University of New South Wales

Abstract
According to the Australian Bureau of Statistics, over one million Australians suffer from Posttraumatic stress disorder (PTSD), an anxiety disorder arising after experiencing a traumatic event in which physical safety or life is threatened. Typically, PTSD patients experience significant impairment in occupational and social functioning as a result. While effective psychological treatment is available, approximately 50 percent of patients do not significantly improve following such treatment. Specific sites of frontal brain dysfunction in PTSD may contribute to this poor response rate by degrading patients' attention and concentration, thereby limiting their ability to engage in psychological treatment. However, to date little research has examined the association between this pattern of brain dysfunction and PTSD treatment outcome. The current study used functional magnetic resonance imaging to examine brain function during a cognitive task (a 1-back working memory updating task) in a group of PTSD patients (n=13). This functional brain activity was then used to predict treatment outcome (measured by post-treatment PTSD symptom severity) following 8 weeks of cognitive behavioural treatment. As hypothesised, reduced activity in frontal brain regions predicted a worse outcome following treatment. These findings may inform refinement of psychological treatment for PTSD which may help improve treatment impact.

"OOPS, I LOST MONEY GAMBLING AGAIN. BUT I JUST CAN'T HELP MYSELF!" DECLINING EXECUTIVE FUNCTIONS IN OLDER GAMBLERS

LWAW 2

Anna McCarrey and Dr Julie Henry
School of Psychology
The University of New South Wales

Abstract
It has been well documented that older adults experience a decline in executive functions as measured by laboratory based experiments. These include verbal fluency and controlled inhibition tasks (Phillips & Henry, 2007). However, older adults function well in real-life situations taxing executive functions such as shopping errands and many household tasks. In the first of its kind, this study aimed to explore the relationship between executive functioning in older Australians and the popular social pastime of gambling. Younger and older adults played an electronic gaming machine programmed to only lose. With intact executive control, players should terminate play as soon as possible. Results showed that older adults played significantly longer, and lost significantly more money than the young adults. Further, this sample of older adults demonstrated significant impairment in several cognitive and executive functioning tasks relative to the younger adults. Implications for executive impairment contributing to maladaptive gambling behaviours in older Australians are discussed.

THE CATIONIC PEPTIDE MELIMINE AND ITS ABILITY TO CONTROL MICROBIAL COLONISATION OF BIOMATERIALS

LWAW 3

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Abstract
Biomaterials are used in a variety of medical devices and implants, such as catheters, prosthetic implants and contact lenses. The use of biomaterial implants and medical devices is an increasingly common and often life-saving procedure. However bacterial infections on biomaterials have emerged as a major problem.

Consequently there is an urgent need to develop surfaces which resist bacterial adhesion and colonisation. We have developed a cationic peptide "Melimine", with excellent broad-spectrum antimicrobial activity. In this study we explored the ability of Melimine to prevent bacterial adhesion when covalently tethered on surfaces using two attachment strategies: non-specific attachment via azide linkers and site-directed attachment via maleimide linker. The surfaces were then characterised and challenged *in vitro* against *P. aeruginosa* and *S. aureus*. Up to 45-fold reduction in bacterial adhesion was observed against using fluorescent microscopy. The orientation and concentration of Melimine on the surfaces were also shown to affect bacterial adhesion. The Melimine-coated surfaces also showed a significant reduction in viable bacteria compared with the controls in a subcutaneous mouse model. Coating of biomaterial surfaces with Melimine represents a promising strategy for the prevention of bacterial adhesion both in vitro and in vivo and its performance is influenced by attachment strategy.

EFFECTS OF RECENT EXPOSURE TO A CONDITIONED STIMULUS ON EXTINCTION OF PAVLOVIAN FEAR CONDITIONING

LWAW 4

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Abstract
Considerable research effort has been dedicated to devising means to enhance extinction - the core mechanism of fear reduction in the treatment of anxiety disorders - which is effective but characterised by relapse. Recently, Monfils et al. (2009) found in rats and Schiller et al. (2010) found in humans that a single non-reinforced re-exposure to a fear conditioned stimulus ('retrieval trial') prior to extinction training attenuated the recovery of fear. We studied this effect utilising both between- and within- subject manipulations. Interestingly, a single retrieval trial prior to extinction training significantly augmented renewal and reinstatement of extinguished responding. These results contrast with those reported by Monfils et al. (2009) and Schiller et al. (2010).We suggest that these contrasting results could depend on the contrasting influences of either: 1) occasion-setting contextual associations versus direct context – CS associations formed as a consequence of the retrieval trial; or 2) discrimination versus generalisation between the circumstances of conditioning and extinction.

CORNEAL RESHAPING USING CUSTOM DESIGNED SOFT CONTACT LENSES

LWAW 5

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Abstract
Orthokeratology (OK) offers a reversible alternative to surgery for the improvement of unaided visual acuity in people with refractive error. With growing evidence to support claims that the method may stop myopia progression, it is gaining increasing attention. The limited market success of OK may be related to rigid lens discomfort. The purpose of this project was to investigate the forces beneath custom-made soft contact lenses (SCL) and their ability to create OK-like change.

Finite element modelling in conjunction with sophisticated lens design software was used to create novel and innovative SCL geometries. Clinical performance was assessed. The achieved corneal changes were quantified using custom developed software for statistical analysis of corneal topographies.

Corneal changes between -3.5D and +1.0D were observed after 8 hours of lens wear. Individual lens design parameters controlling pressure distribution, and thereby corneal changes, were identified. Correlation of finite element model prediction and observed topographical changes was high.

SCLs were used to significantly change corneal shape. A hurdle that is yet to overcome is a central area of corneal steepening observed with all lens designs. However, this “centre near” effect may offer potential for the correction of presbyopia.

FROM SAHARA TO AMAZON – ELIMINATE DRY EYE

LWAW 6

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Abstract
Dry eye is a disease affecting over 50% of the elderly population, as well as contact lens wearers and those who work long hours with computer screens. The ocular surface is very dependent upon its tear film to provide both lubrication and nutrients. When this tear film is deficient, or unstable, dry eye results, leading to symptoms of discomfort and potential damage to the ocular surface. It can vary in severity, with the severe forms of the disease being debilitating. Currently, commercially available therapies are ineffective in treating dry eye symptoms. Interestingly, rabbits have been reported to have more stable tears than humans, due to unique biological components in their tears. It is hypothesized that mimicking rabbit tears would potentially lead to a more stable tear film in humans. This research project therefore aims to understand the differences in tear film structure between humans and rabbits and how these affect the tear stability. The outcomes are aimed to lead to the development of novel ways to increase tear film stability and hence provide an effective way to treat dry eye.

TARGETING NEGATIVE INTERPRETATIONS OF INTRUSIVE MEMORIES IN DEPRESSION: WHAT WORKS BEST TO REDUCE DISTRESS?

LWAW 7

Jill Newby and Michelle Moulds
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Abstract

Depression is a debilitating condition that affects one in five Australians during their lifetime(1), and has an estimated annual societal cost of $3billion(2). Depressed individuals commonly experience negative events (e.g., retrenchment), which, in their aftermath, are remembered in the form of distressing intrusive memories (IMs). Recent studies indicate that negative interpretations of IMs (e.g., "This memory means I am a failure") are associated with increased memory-distress, and potentially contribute to the maintenance of depression over time(3). However, no studies have examined the effectiveness of targeting negative interpretations of IMs in depressed samples. In the current study, participants (N=45) with high depression symptom levels were randomly allocated to one of three (single session) conditions: cognitive behavioural education (CBT), computerised training of positive interpretations of IMs (CBM), and wait-list control (WL), to compare their efficacy in reducing intrusion-related distress and other IM variables. At one week post-training, the CBT group reported lower distress levels compared to WL (whereas, the CBM group reported intermediate distress). This is the first study to demonstrate the utility of using a CBT module to assist depressed individuals cope with intrusive memories, and has novel and exciting implications for the enhancement of psychological treatments for depression.

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VOLUNTARY RUNNING REVERSES AGE-ASSOCIATED COGNITIVE DECLINE AND RESTORES SYNAPTIC GROWTH AND NEUROGENESIS IN THE AGED RAT

LWAW 8

Joyce Siette and Fred Westbrook
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Abstract
Brain ageing in the rodent is associated with synaptic dysfunction and memory decline. The aims of this study were to: 1) identify a single-trial recognition memory paradigm sensitive to age-related change; 2) assess whether voluntary wheel running reduces the adverse effects of ageing on cognitive performance; and 3) characterize the neural substrates for such behavioural changes.

Aged and young Fischer rats were assessed using an Object Recognition (a hippocampal-independent; OR) and Place Recognition (a hippocampal-dependent; PR) memory task. Following baseline testing, animals had free access to a running wheel for 8 weeks. Animals were then re-tested, sacrificed and underwent histological procedures accordingly.

Results indicate that aged rats are only impaired on the PR memory task compared to young rats. However, voluntary running is able to selectively reverse PR performance, while having no effect on OR performance in aged rats. Aged control rats also had significantly lower synaptic density across several hippocampal subregions compared to young control animals. Voluntary running increased synaptophysin densitometric measures in all hippocampal subfields in aged animals. Neurogenesis levels were also increased in response to voluntary running in both young and aged animals. However, only synaptic density was strongly correlated to PR performance. It appears that running produces a complex series of changes on these brain-behaviour correlations.

EARLY- LIFE STRESS RESULTS IN PRECOCIOUS EMERGENCE OF RENEWAL AND REINSTATEMENT EFFECTS, AND EARLY INVOLVEMENT OF GABA INHIBITION IN FEAR EXTINCTION IN THE DEVELOPING RAT

LWAW 9

Bridget Callaghan and Professor Rick Richardson
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Abstract
In adult rats, fear to an extinguished CS can be recovered if subsequent presentations of the CS occur in a different context than extinction training (i.e., renewal) or if animals are given a post-extinction reminder shock (i.e., reinstatement). Further, the importance of GABA in the expression of extinction is well established in adult rats. Recent research in our laboratory has demonstrated that extinction is mediated by fundamentally different processes early in development. Specifically, whereas postnatal day (P) 23 rats exhibit the renewal and reinstatement effect following fear extinction, P17 rats do not (Kim & Richardson, 2007; Yap & Richardson, 2007). Further, expression of extinction is GABA-dependent in P23 rats but is GABA-independent in P17 rats (Kim & Richardson, 2007). Finally, the neural circuitry underlying extinction across development is different (Kim, Hamlin, & Richardson, 2009). Given the impairing effects of stress on extinction of fear in adult rats (e.g., Miracle et al, 2006), and the effect of stress in brain regions involved in extinction (Rodrigues, LeDoux, & Sapolsky, 2009), the present series of experiments examined the effect of early-life stress on developmental dissociations in extinction. In the first experiment we replicated earlier studies showing that standard-reared P17 rats do not exhibit the renewal effect; further, and more importantly, we demonstrated that maternally separating animals (for 3 hours per day on P2-14) resulted in early emergence of the renewal effect at P17. In a second experiment we replicated earlier findings that reinstatement of fear is not evident following extinction in standard-reared P17 rats and also showed that the reinstatement effect was observed in maternally separated P17 rats. In Experiment 3 it was shown that a pre-test injection of the GABA antagonist FG7142 impaired the subsequent expression of extinction in P17 animals, but only if those animals had experienced maternal separation early in life. Consistent with past research from our laboratory, GABA antagonism did not impair expression of extinction in standard-reared P17 animals. Taken together these findings demonstrate that P17 animals with a history of early-life stress exhibit qualitative differences in extinction relative to their same-age, non-stressed contemporaries, and have important theoretical and clinical implications.

ENERGY AND MATERIALS TECHNOLOGIES

EMT

ENHANCED WOUND REPAIR THROUGH THE COALESCENCE OF URINARY BLADDER MATRIX AND LASER ACTIVATED CHITOSAN BIOADHESIVE

EMT 1

Tania Ahmed and Associate Professor John Foster
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Abstract
Tissue repair and reconstruction requires an ideal scaffold that is biocompatible with the host tissue for effective repair and regeneration. The extracellular matrix derived urinary bladder matrix (UBM) has been employed in therapeutic applications for tissue repair and shown to facilitate recruitment of marrow-derived stem cells resulting in remodeling of damaged tissue. Current techniques for tissue reconstruction also involve the use of sutures, with documented disadvantages. SurgiLux® is a laser-activated chitosan adhesive that enhances the growth of several cell lineages. This study adopted a novel approach by incorporating SurgiLux® and UBM to fabricate an innovative therapeutic scaffold that holds considerable potential in the field of tissue repair. Physiochemical examination of the combined adhesive properties revealed that UBM-SurgiLux® displayed increased surface rugosity, lower crystallinity and a greater wound repair strength compared to SurgiLux® films. Cellular response at the material interface revealed maintenance of regular morphology and enhanced growth of 3T3 fibroblasts compared to SurgiLux® films alone. Expression protein profiling of UBM composition identified key proteins that exhibit augmentation of cell growth if implanted as nerve conduits due to their enhanced capability to repair wound. Our results suggest that the coalescence of UBM with SurgiLux® leads to the prospect of developing successful laser activated UBM-SurgiLux® biomaterials for enhanced wound repair and tissue reconstruction.

BIO-ABSORBABLE METALLIC GLASSES

EMT 2

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Abstract
Bio-absorbable implants are widely used in orthopaedic surgery today and the worldwide market is expanding rapidly. Recent advances in materials processing has enabled the production of notable sized metallic glasses, which is composed of essential nutrients in the human body. MgZnCa metallic glass is a step forward from the other Mg based crystalline bioabsorbable implant materials. It has improved corrosion resistance, owing to the increased Zn and Ca uptake, structural homogeneity and the lack of grain boundaries. Significant reduction in hydrogen evolution. Being a metallic glass, it can also be formed like polymers with super-plastic forming techniques. With many desirable properties, this new class of biomaterial is currently being developed for use as bioabsorbable stents. Application of metallic glass coating can assist in tissue regeneration and also used for controlled drug release.

USING CARBON COMPOSITE PELLETS TO IMPROVE THE PERFORMANCE OF BLAST FURNACE IRON MAKING BY LOWERING OPERATING TEMPERATURES

EMT 3

James Dongmin Jang and Professor Veena Sahajwalla
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Abstract
Due to growing emphasis on environmentally sustainable processes, the ironmaking industry has had to implement innovative operating practises which include using low-quality raw materials to decrease energy consumption and to improve production efficiency. These novel processes involve improving the blast furnace efficiency by lowering the operating temperatures. In blast furnace operations, the carbothermic reduction is dominated by the direct reduction in the initial stage of reaction, while it is influenced by the indirect reduction and the carbon solution-loss reaction when the CO partial pressure exceeds a certain value. These reactions are strongly dependent on the temperature. Carbon composite pellets were prepared using blends of hematite and graphite. Our studies showed that the reduction can be greatly improved by increasing the contact area between the hematite and graphite particles. Also, reduced iron in close proximity to the graphite catalysed the solution-loss reaction of carbon; while the residual carbon in the pellet would assist in carburizing the iron, thereby lowering its melting temperature to 1170ºC. This would help to lower the operating temperatures within the cohesive zone in the blast furnace, resulting in significant improvements in the process efficiency.

DRAINAGE CHARACTERISTICS DUE TO DIFFERENT DRIPPING DISTRIBUTIONS

EMT 4

Yen Chih Chen and Aibing Yu
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Abstract
Blast Furnace, as a primary 24-hr ironmaking device, has been studied over a century, but the phenomena in its lower part, hearth, are not completely transparent, particularly the slag drainage behaviour. To reproduce the behaviour, previous numerical models were developed to track the slag-gas interface during the drainage process with liquid dripping uniformly from the upper part. The interface is crucial in determining the efficiency and stability of the blast furnace operation because it prevents the internal gas from leaking and disturbing the inner status. However, the predication can highly deviate once the pattern becomes non-uniform due to gas drag. Therefore, this study targets at clarifying the potential changes and offers a guideline for a more effective drainage operation. The investigation is conducted within a computer simulation model featuring in solving the velocities of each phase at the interface separately, and verified by comparing the previous experimental data. The current results reveal that the non-uniform dripping pattern biased toward the taphole can decrease the slag residual ratio by up to 35\%. Besides, the value can plunge furthermore with narrowing the dripping range. Therefore, a further rise in the productivity is viable through manipulating the dripping distribution of the upper part.

REDUCTION OF FEO IN EAF STEELMAKING SLAG BY METALLURGICAL COKE AND WASTE PLASTICS BLENDS

EMT 5

James Dankwah and Professor Veena Sahajwalla
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Abstract
In Australia, the use of plastics has increased tremendously over the last few decades, but less than 20% of the waste plastics are recycled. The rest is usually land filled, which poses major environmental problems. The solution to this problem involves the development of novel environmentally- benign technologies that would utilise these waste materials. This work investigates the reduction of EAF slags (47% FeO) by blends of metallurgical coke with waste plastics (HDPE) at 1550°C. The experiments were conducted in a laboratory-scale horizontal tube furnace, and were coupled with off-gas analysis using an infrared gas analyser and a multiple gas chromatographic analyser. The results indicate that the rate of FeO reduction in slags is significantly higher when the coke/plastics blends were used compared to pure coke. Moreover, CO2 contents in the off-gas were observed to decrease as the polymer content in the blend was increased. Additionally, the degree of carburisation and the removal of sulphur from the metal improved considerably when the coke was blended with plastics. The observed improvement in the rates of reduction, carburisation and sulphur removal is attributed to the reactions of hydrogen evolved from the waste plastics at these high temperatures.

STRENGTHENING MECHANISM AT THE SMALLEST LENGTH SCALE IN THE NANOLAYERED ALUMINIUM/PALLADIUM THIN FILMS

EMT 6

Pranesh Dayal and Professor Mark Hoffman
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Abstract
Nanolayered materials offer enhanced mechanical properties such as hardness but the strengthening mechanism is not well understood when the layer thickness approaches a few nanometers. Here, the fabrication, mechanical properties measurement and deformation behaviour study of multilayered aluminium/palladium (Al/Pd) thin films with individual layer thickness varying from 1-40 nanometres are presented. Nanoindentation tests revealed that the mechanical strength of the Al/Pd multilayer films is much higher than that of pure Al or Pd film. With just 6.5 % (v/v) Pd, an enhancement of hardness of ~200% was observed for nanolayered Al/Pd compared to the hardness of pure Al film. A maximum hardness enhancement of up to 350 % was observed for nanolayered Al/Pd samples compared to the hardness of pure Al film when the layer thickness was 1 nm and Pd was 50 % (v/v). Uniaxial compression of sub-micron sized pillars, fabricated in nanolayered thin films, followed by high-resolution microscopy revealed layer thickness dependent deformation behaviour, changing from dislocation driven plasticity at large layer thickness to shear due to grain rotation via grain boundary sliding at small layer thickness. The transition occurs at about a layer thickness of 10 nm where a mixture of the two mechanisms is apparent.

SURFACE MODIFICATION OF IRON OXYHYDROXIDE MATERIALS: SYNTHESIS, APPLICATIONS, AND THEORETICAL MODELLING

EMT 7

Jeffrey Yue, Xuchuan Jiang and Aibing Yu
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The University of New South Wales

Abstract
Iron oxides and oxyhydroxides (e.g., goethite, akaganéite, and hematite) are the anti-corrosive products of steel. They also show potential applications in many areas such as catalysis, gas sensing, nanoelectronics, and biomedicine. The functional properties of such materials are heavily dependent upon the morphology and size of nanoparticles. This work presents simple but efficient strategies to prepare one-dimensional goethite (α-FeOOH) and akaganéite (β-FeOOH) nanorods under ambient conditions. It was observed that the surfactants, e.g., cetyltrimethylammonium bromide (CTAB), play an important role in goethite, while the ions, e.g., chloride, are important in the formation and growth of akaganéite nanostructures. Metal nanoparticles were also found to uniformly deposit onto the surface of both iron oxyhydroxide materials to form metal/iron oxide nanocomposites. The molecular dynamics (MD) method is used in this work to understand the underlying principles governing particle growth through the analysis of the interaction energies between crystal surfaces and surface ions/molecules/clusters. This will be useful for shape-controlled synthesis of nanoparticles for desired functional properties.

PHYSICAL AND MECHANICAL PROPERTIES OF KENAF TECHNICAL FIBERS

EMT 8

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The University of New South Wales

Abstract
Studies were conducted to characterize the kenaf fiber bundles and to investigate the strength properties of treated and untreated fibers. Kenaf bast fiber are composed of cellulose reinforced lignin composite material. Structurally the properties of kenaf fibers are non-uniform with random arrangement of fiber cells. The single cells in the fiber bundles were found to have a length of 1.9 ± 0.3mm with diameter of 14.9 ± 3.8µm. The lumen diameter and cell wall thickness was 8.1±2.5µm and 5.0±1.3µm respectively. Soaked fibers possesed the highest value of fineness with an average value of 72 denier, followed by ultrasonicated fibers with 56 denier compared with 48 denier for untreated fibers. The mechanical properties of the kenaf fiber bundles showed large scatter as has been reported previously. The effect of aqueous fiber treatment on the mechanical properties was found not to be statistically significant. The tensile strength of the fibers showed a general increase with the decreasing bundle diameter. In general, the mechanical properties of kenaf technical fibers can be describes by two-parameter Weibull distribution. According to the data obtained from this study, kenaf fibers show considerable potential for use in high performance plant fiber composites.

METAL-ORGANIC FRAMEWORKS: FUNCTIONAL MATERIALS BY FORM AND DESIGN

EMT 9

Muhammad Nadeem and Associate Professor John A. Stride
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The University of New South Wales

Abstract
The need to develop new materials responsive to increasingly taxing technological and industrial demands requires fundamental research into detailed engineering of the materials at an atomic and molecular level. Metal-organic frameworks (MOFs) are perfect examples of this approach and have a demonstrated ability of guest uptake, making them prime candidate materials to fulfil the technical ambitions of the hydrogen economy, whilst also being targeted as smart catalysts and sensor materials. The inclusion in MOFs of metallic ions possessing magnetic moments, introduces yet another facet to molecule-based magnets and magneto-structural correlations. A particular interest in this context is the design of molecular systems combining magnetism and porosity. The aim of this work is to elucidate the exchange interactions across a number of materials with a view to maximising the exchange energy and as a consequence of this, the critical temperatures and coercive fields in 3D systems. At the time of writing, we have a sufficient number of samples ranging from 1D-3D porous and non-porous MOFs; for each of which we have good single crystal X-ray data at 150 K and magnetic data over the temperature range of 300-2K. We anticipate that several of our materials have shown magnetic ordering and highly novel materials for size dependent gas selectivity.

USE OF KENAF FIBRES IN THERMOPLASTIC COMPOSITES AS SUBSTITUTES FOR WOOD PLASTIC COMPOSITES

EMT 10

Niphaphun Soatthiyanon and Professor Alan Crosky
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Abstract
Kenaf fibres thermoplastic composites are potential to be substitutes for wood plastic composites. In this study, the chopped kenaf fibres and wood flour with a 40 wt% loading were processed with high-density polyethylene (HDPE) and polypropylene (PP) used as the matrix materials for property comparisons between the kenaf fibre composites and the wood flour composites. The composites made with and without 3 wt% maleic anhydride coupling agents were compound in an extruder and then hot pressed into sheet for mechanical testing. It was found that tensile and flexural moduli and impact strength of the kenaf fibre composites were superior to those of their wood fibre counterparts. There was, however, no significant increase in tensile and flexural strengths. The PP composites were stiffer and stronger than the HDPE composites, but had lower impact strength. The addition of the coupling agents had positive effects on tensile modulus, tensile strength and flexural strength. However, there was no significant improvement in flexural modulus. The coupling agents had no effects on impact strength of the PP composites, but had negative effects on the impact strength of the HDPE composites. The coupling agent addition was more effective on the kenaf fibre composites than on the wood flour composites.

CYCLIC FATIGUE CRACK GROWTH IN ULTRAFINE GRAINED ALUMINIUM

EMT 11

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The University of New South Wales

Abstract
The cyclic fatigue crack growth of ultra fine grained (UFG) aluminium alloy and their coarse grained (CG) counterparts was studied. Samples of (UFG) aluminium alloy were prepared through equal channel angular pressing (ECAP) of 6061 aluminium alloy heat treated at 400C for 8 hours to the overaged condition. Microstructural analysis through transmission electron microscopy (TEM) revealed that grain size generally decreased with the number of passes and ranged between 300-450nm. Grain sizes were similar for both TEM sample made by twin jet electro polishing and focused ion beam (FIB) milling. Initial EBSD analysis of microstructure has been conducted but further refinement of electro polishing technique is needed for valid results. Vickers hardness measurements were made on 3 planes of the samples showing a slight variation between the planes and showing that hardness generally increases with number of passes. Cyclic fatigue crack growth behaviour was determined through 4 point bend fatigue testing of single edge bend specimens. Results show that UFG 6061 aluminium alloy exhibits a lower resistance to fatigue crack growth than its CG counterparts. The fatigue crack was deflected in tests performed by Dr Jingli. More testing is required to validate these results and also determine the fatigue crack growth behaviour near the threshold region.

CONDUCTING POLYMER-LIQUID CRYSTALLINE HYBRIDS FOR ORGANIC SEMICONDUCTOR APPLICATIONS

EMT 12

Thomas Ellis and Associate Professor John Stride
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Abstract
Excellent semiconducting properties are nearly the sole province of crystalline materials which makes any reasonable flexibility impossible as well as requiring very precise crystal growth methods like those used in the recent OLED displays.1 However, what if it were possible to make materials with all the benefits of crystals, with the flexibility of plastics?

Liquid crystals hybridised with conducting polymers may provide the robust flexibility with all the benefits crystals that comes with liquid crystals. Using discotic based liquid crystal provide the crystallinity, conductive paths, and self-assembly properties.2 The problem to overcome is to lock in the liquid crystal phases that only form in a narrow temperature range. Electro-polymerisation uses known chemical groups that form polymers only when an electric field is applied.3 This will allow us to stabilise the liquid crystal phases and lock in the liquid crystals by simply flicking a switch.

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CLIMATE, ENVIRONMENT AND SUSTAINABILITY

CES

MECHANISMS OF SALT TOLERANCE / SENSITIVITY

CES 1

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Abstract
Increased salinity in cultivated land of Australia and worldwide is a growing problem, affecting food security. Small percentage of plant species, and only a few crops, can thrive at high salinity. How do they do it? Multiple adaptation mechanisms are required, from single cell level to whole plant. Our experimental system, the giant-celled characeae, offers insights into fundamental responses to salt stress at cellular level. Characeae are the sister group to the ancestors of higher plants and contain naturally salt-sensitive and naturally salt-tolerant genera: Chara australis and Lamprothamnium. Comparative study of their electrophysiology is revealing ancient motifs of survival in salty environment. Salt tolerant Lamprothamnium is able to sense decreased cell pressure (turgor) and translate it to increased proton pumping when exposed to high salt medium. Thus energized, membrane transporters restore cell turgor. Salt sensitive Chara australis exhibits decline in proton pumping, even when exposed to low salinity. Characteristic noise in the membrane potential difference (PD) suggests activation of proton (or hydroxide) channels that collapse vital proton electrochemical gradient. Membrane PD decline and spontaneous action potentials are the last stage of salt stress. These findings may be extrapolated to roots of land plants.

ECOLOGICAL CONSIDERATIONS FOR MANAGEMENT OF MARINE POPULATIONS THROUGH STOCK ENHANCEMENT

CES 2

Faith Ochwada and Matthew Taylor
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The University of New South Wales

Abstract
Effective management and conservation of biotic marine resources relies on a firm understanding of the ecological processes that regulate populations. Stock enhancement is a commonly used marine management strategy that involves releasing large numbers of hatchery-reared individuals into the wild to augment natural supply. Despite its appeal, however, empirical evidence of the ability of stock enhancement to restore populations sustainably is scarce, and its failure can often be traced back to a poor understanding of the ecological factors that influence released species and recipient biological communities. Using Penaeus plebejus Hess as a test species, this research demonstrates how preliminary ecological assessments can determine the capacity of populations to recover and persist following stock enhancement and limit negative ecological impacts on recipient communities. The presence of aquatic macrophyte habitat is identified as key a determinant of optimal health and survival in P. plebejus. The roles of ecological processes, such as habitat preference, predation and competition, in influencing the biological success of this species' enhancement are also illustrated. This research provides strong experimental evidence to support an ecological approach to stock enhancement and will assist in determining the practicality and effectiveness of stock enhancement as a marine management option.

BIOACTIVES AGAINST THE NEMATODE CAENORHABDITIS ELEGANS REVEALED BY FUNCTIONAL GENOMICS OF THE MARINE BACTERIUM PSEUDOALTEROMONAS TUNICATA D2

CES 3

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Abstract
Marine bacteria are a rich, yet under-explored, resource of inhibitory bioactives against a range of eukaryotic target organisms. Identification of those inhibitors however requires a culturable or genetically tractable producer strain, a prerequisite that is not often fulfilled. This study describes a novel functional genomic screen that is based on expression of inhibitors in a heterogenous recombinant host (i.e. Escherichia coli). Functional libraries were screened by selective grazing by the nematode Caenorhabditis elegans, in a simple, rapid, high-throughput manner. We applied our approach to discover inhibitors of C. elegans produced by the marine bacterium Pseudoalteromonas tunicata D2, a model organism for exploring a range of antagonistic activities between bacteria and eukaryotes and a known producer of several toxic compounds. Expression of P. tunicata DNA in E. coli and grazing selection by the nematode Caenorhabditis elegans identified two clones, with slow- and fast-killing modes of action. Genomic analysis of the slow-killing clone revealed that the activity was due to a small molecule, tambjamine, while the fast killing activity involved a gene encoding for a novel protein. Microscopic analysis showed substantial colonisation of the intestinal lumen, or rapid death of the nematode without colonisation, for the two activities respectively. The novel functional genomic screen presented here therefore detects new eukaryotic inhibitors with different chemical structure, kinetics and predicted modes of actions.

GENES, CULTURE AND SPONGES IN BOTTLENOSE DOLPHINS

CES 4

Anna Kopps and WB Sherwin
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Abstract
Genes and culture are two inheritance systems through which information can be passed on from one generation to the next. An example of culturally transmitted behaviour is the sponging behaviour in bottlenose dolphins. Sponging is a foraging behaviour in which bottlenose dolphins wear conical sponges as tools over their rostrum to probe the substrate in Useless Loop, Shark Bay, Western Australia. Most spongers are female, and they all share the same maternally inherited mitochondrial DNA haplotype, thus descend from ‘sponging-Eve’ and are all members of the same matriline. We are interested in the extent, variety and effects of culture on a population of bottlenose dolphins. We found a distinct separation between matrilines and habitat. The genetic difference found between habitats was also found in the social structure: Animals from different habitats do not spend much time with each other even though they are only separated by tens of meters. We found that socially learnt foraging specializations appear to lead to habitat and associate preferences.

INSECTIVOROUS BAT ACTIVITY IN SYDNEY'S URBAN LANDSCAPE: DOES PRODUCTIVITY MODERATE THE IMPORTANCE OF BUSHLAND?

CES 5

Caragh Threlfall and Associate Professor Peter Banks
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The University of New South Wales

Abstract
The process of urbanisation can be detrimental to wildlife, but the ecological mechanisms governing species persistence are largely unknown. We examine the impacts of urbanisation on insectivorous bats in Sydney, Australia. We present data on species richness and activity (bat passes per night) collected systematically using ultrasonic bat detectors from 30 randomly selected landscapes (each 25 km2). Landscapes were categorised into classes: urban (>5 dwellings/ha and <10% vegetation cover); suburban (10-40% vegetation cover); and vegetated (<5 dwelling/ha and >40% vegetation cover). Within the 'suburban' landscape category, we also investigated a landscape productivity hypothesis and compared the relative effects of contrasting geology (shale, sandstone, and shale/sandstone transition) on species richness and activity. Four landscape elements were sampled within each landscape, including remnant bushland (>2 ha), riparian areas, open space/parkland and residential. Both nightly activity and species richness were significantly higher in suburban areas along the urban gradient, and activity was very low in urban sites. Nightly activity was significantly higher in bushland sites compared to open space sites, across all landscape categories. Underlying geology underpinned variation in activity and richness between landscapes. We suggest that productivity in shale areas is higher affecting insect density and thus bat persistence in this landscape.

BIODEGRADATION: APPETITE FOR THE UNUSUAL

CES 6

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Abstract
The Botany Sands Aquifer (BSA) is contaminated with a carcinogenic solvent known as 1,2-Dichloroethane (DCA). Several bacteria are known to respire DCA although none tolerate the harsh conditions in the BSA. The aquifer is naturally acidic and also contaminated with chloroform, inhibiting natural DCA biodegradation. The aim of this project is to generate and characterise a culture that can degrade DCA in the BSA. Groundwater samples from the BSA were subject to anaerobic enrichment at pH 5.5 for two years. Activity of the culture over a pH range and chloroform and DCA concentration range was evaluated and the composition of the microbial community was characterised. Ethene was the sole DCA breakdown product. The anaerobic enrichment cultures degraded DCA at pH 5.5 at 0.3 mM/day. The culture can tolerate up to 6 mM DCA and 20 mM chloroform. It is dominated by Desulfitobacterium lineages that are known to degrade DCA. This work generated a DCA degrading culture that transforms DCA to the non-toxic gas ethene and is unique in its tolerance to a pH of 5.5, 6 mM DCA and 20 mM chloroform. It is the first DCA degrading culture produced in Australia and the only environmentally robust culture produced globally.

MELITA PLUMULOSA: THE GENETIC MINING CANARY OF OUR ESTUARIES

CES 7

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Abstract
Anthropogenic effects such as contamination are known to affect the genetic structure of populations. To monitor genetic diversity and environmental contamination in eastern Australia, toxicity studies have employed the endemic sensitive benthic amphipod Melita plumulosa. However, the underlying genetics of this species remains largely unexplored. We examined the genetic variability of natural populations of M. plumulosa from the Parramatta River in Sydney following an industrial chemical spill. Genetic variation was examined at the mitochondrial cytochrome c oxidase subunit I (COI) locus Most notably, Tajima's D was significantly negative and the frequency of the most common haplotype was higher than expected amongst amphipods collected immediately downstream from the spill for up to 12 months following the spill. These results suggest that the spill may have had a significant localized effect on the genetic diversity of M. plumulosa within the catchment. These data also suggest that M. plumulosa is a sensitive molecular bioindicator for the monitoring of environmental contamination in eastern Australian waterways, and that more research is needed to understand the full impact of toxicant exposure on the genetic structure of this species.

CLIMATE CHANGE AND EMERGING DISEASE: THE ROLE OF BACTERIA IN THE BLEACHING OF A MARINE RED MACROALGA

CES 8

Neil Fernandes Rebecca Case, Alexandra Campbell, Sharon Longford, Peter Steinberg, Staffan Kjelleberg and Torsten Thomas
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Abstract
Delisea pulchra is a temperate red macroalga that chemically defends its surface from colonization through the production of secondary metabolites known as furanones. We have observed that this alga is affected by a "bleaching" disease particularly during summer when water temperatures are elevated and the concentration of the furanones is often lowest. This bleaching phenomenon could be induced in vitro by the bacterial strain Nautella italica R11 at elevated temperature and when algal furanone production was experimentally inhibited. In order to better understand the molecular basis of disease, we analysed the genome of strain R11 and other genetically related that are pathogenic and non-pathogenic to D. pulchra. Comparison to non-pathogenic bacteria revealed a shared set of genes likely to represent molecular factors of virulence. Of particular interest is the identification of a unique QS-dependent transcriptional regulator, as furanones from D. pulchra are efficient QS-inhibitors and hence could interfere with expression of virulence genes in the pathogens. This study gives support to the model that environmental change (such as global warming) can impact on disease dynamics by alteration of both, the chemical defense of host organisms and subsequent modulation of virulence gene expression in pathogens leading to an opportunistic infection and disease.

OLD PARADIGMS AND NEW THREATS: THE ROLE OF PROPAGULE PRESSURE IN BIO-INVASION

CES 9

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Abstract
Recent models implicate propagule pressure, or the amount of invasive seed or larvae introduced to a new ecosystem, as a strong determinant of invasive species spread. There exists, however, a paucity of work that experimentally tests this prediction. This is particularly evident in marine ecosystems where, paradoxically, the rate of bio-invasion is thought to be strongest. In this system, global shipping and ballast water exchange have been the cause of >51% of coastal marine invasions. Using novel, field based factorial experiments, I first test the importance between the intrinsic elements of propagule pressure; arrival intensity and frequency of introduction. I demonstrate substantially greater invasive success arising from less dense, more frequent invasive introductions using larvae of the invasive Pacific Oyster, Crassostrea gigas. Several further studies, investigating real world patterns of recruitment and survival of invasive species in commercial ports and harbours reinforce the importance of larval ecology to anthropogenic modification of natural systems.

My study provides the first quantitative evidence from marine systems that, used in conjunction with current theoretical models suggests more of an emphasis on controlling frequency of larval introduction, rather than the intensity of each event.

MARINE PESTS PLUS POLLUTION: RECIPE FOR A SUPER PEST!

CES 10

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Abstract
Marine aliens are taking over the world, aided and encouraged by anthropogenic disturbance. Marine pests, or non-indigenous species, are being spread around the globe on human vectors and introduced into areas that are highly impacted by human activities such as harbours, ports and marinas. Mostly commuting on the hulls of boats, these habitats are exposed to many different pests again and again. Pollution is also a major form of disturbance in these environments, with toxic consequences for our native flora and fauna. Yet the marine pests appear to be surviving and thriving in these polluted conditions, inferring some form of tolerance to pollution. I have found that the metal copper, an increasingly common and toxic marine pollutant, is actually enhancing the successful spread of a marine pest. A disturbing result considering copper is used on the hulls of boats in an attempt to prevent this. Instead the marine pest has rapidly evolved to optimise the toxic conditions created, by growing faster and breeding more, even seeking out polluted environments to live in. It is clear from my results that this marine pest appears to be enjoying world domination by benefiting from a toxic human contaminant.

IMPACTS OF CONTAMINANT SOURCES ON MARINE FISH ASSEMBLAGES: A REVIEW, META-ANALYSIS, AND EVIDENCE FROM THE FIELD

CES 11

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Abstract
Due to a variety of anthropogenic stressors many fish species have experienced both rapid and long term population declines. We conducted a review and meta-analysis to understand the effects of common contaminant sources on the abundance and richness of fish. Over 1650 abstracts were examined as part of a systematic literature review but only 47 papers met the acceptance criteria. These studies were well distributed between contaminant sources (industrial effluent, run-off, sewage and fish farms) and sampling habitats (bare sediment, vegetated habitats, rocky bottom & rocky reef, and coral reef) with no category accounting for more than 36%. The majority of industrial effluent (62%) and run-off (67%) studies reported negative responses of fish abundance to contamination. Fish farms were associated with increased abundance (102.6x) and richness (1.56x) of fish. Sewage studies reported an equal number of negative and positive responses for both abundance and richness. Analysis suggested that the abundance of fish assemblages in coral reefs is negatively impacted by pollutants and that these reefs are more sensitive than other habitats. 9 families were represented in 3 studies and qualitative analysis suggested that Percidae and Pomacentridae abundance was more sensitive to pollutants than other fish families. Overall weak trends were observed for species richness, which may suggest that contamination is not having a large impact on marine fish diversity. This contrasts to studies of marine invertebrates which generally find negative impacts of all contaminant classes on diversity in all habitat types. Our results suggest that some forms of contamination are having sizeable effects on fish abundance and are likely to be of commercial and conservation significance.

SURFACE FLOODING OF A WARM CORE EDDY

CES 12

Helen Macdonald and Moninya Roughan
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The University of New South Wales

Abstract
An approximately 3km resolution version of the Regional Ocean Modelling System (ROMS) is configured for the coast off southeast Australia. This model is used to produce ocean state estimates of a warm core eddy in October 2008. The model output is assessed against data and can reasonably reproduce a warm core eddy as it is flooded by the East Australian Current (EAC). The model is then used to describe the structure of the submergence in this eddy.

THE DISTRIBUTION OF THE CHACMA BABOON (PAPIO URSINUS) PRIOR TO EUROPEAN COLONISATION

CES 13

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Abstract
The distribution of the chacma baboon (Papio ursinus) in Southern Africa is ambiguous. Indentified maps lack precision and the finer scale detail required for conservation planning and ecological understanding. Distributions are essential for population estimates, habitat types and even population stability. This is a problem as the baboon's conservation status is in a state of flux. Anecdotal evidence indicates that many local populations have become extinct and others are in decline.

This research aimed to develop a predicted distribution for this species prior to European colonization and provides a building block for comparisons with present day distributions. This was done using a set of environmental parameters within a GIS model, showing the areas likely to have been inhabited prior to European influence.

Results show the current notion of the chacma being a mountain baboon is unlikely and could be due to anthropogenic impacts on their range. Field work in KwaZulu-Natal province supports this, demonstrating a severely declining range. Additionally, it appears baboons prefer cooler temperatures, which may have lead to them inhabiting the cool, less disturbed mountains. It is likely that many areas inhabited today would have been selected against in the recent past.

WIND, TEMPERATURE AND CURRENT OBSERVATIONS FROM A LONG TERM CONTINENTAL SHELF MOORING

CES 14

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Abstract
Moored observations of wind, waves, temperature and currents have been collected off the coast of Sydney since November 1990. This long term mooring, designated the Ocean Reference Station (ORS), was set up and operated under contract to Sydney Water Corporation. The ORS is located approximately 3 km off the coast of Sydney, NSW (near Bondi) in nominally 65 m of water. In May 2006, the configuration of the mooring was changed and it no longer collects wind data. Forcing by the wind is very important in driving oceanographic processes, thus knowledge of the wind speed and direction is essential for interpreting variations in currents and temperature. Wind data collected at the ORS, prior to the configuration change are compared to data collected from various sites in Sydney by the Bureau of Meteorology to determine the site on land that best represents wind speed and direction over the ocean. The data will then be used to describe seasonal differences in upwelling at this location. Upwelling is when cold nutrient rich water is brought to the surface and is very important in stimulating primary productivity.

CHARACTERIZATION OF A BACTERIA-DERIVED CHEMICAL SIGNAL THAT TRIGGERS LARVAL METAMORPHOSIS IN ACROPORID CORALS

CES 15

Jan Tebben and Peter Steinberg
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*The U**niversity of New South Wales***

Abstract
Many benthic marine invertebrates, e.g. corals and sponges, have separate planktonic and bottom dwelling life stages linked by a metamorphic event. The analysis and characterization of chemical signals which control settlement and metamorphosis is fundamental to our understanding of the distribution and abundance of marine organisms, their population and community variability. Despite more than 30 years of experimental evidence that marine bacterial biofilms stimulate settlement events in invertebrate larvae, no chemical signal derived from biofilms has been identified. A bioassay-guided screening of 200 bacterial isolates from a crustose coralline alga resulted in a single bacterial strain that induced high levels of larval metamorphosis of the reef-building coral Acropora millepora. In this bacterium, we have for the first time identified the metabolite that causes larval metamorphosis in this coral. This finding is fundamental because it verifies for the first that larval metamorphosis results from a chemically mediated interaction of bacteria and invertebrate larvae. The knowledge of chemical signals that coordinate larval settlement in corals may provide bio-technologically interesting leads for conservation or rehabilitation of coral reefs hit by human activities, pollution, predator infestations, or climate change.

CONSERVATION THROUGH A PET INDUSTRY: THE SUITABILITY OF SUGAR GLIDERS AS PETS

CES 16

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The University of New South Wales

Abstract
Globally there are many threats to wild populations of animals. National Parks networks and other "traditional" conservation initiatives work in some cases however these can be costly and are limited to specific geographic regions. As such, new cost effective means of conserving and protecting endangered species are required. One proposed method of doing this is to establish a well regulated pet industry which could be financially self-sufficient and achieve measurable conservation goals. However, little is known about the suitability of Australian marsupials as companion animals. This project uses a test species, Petaurus breviceps (Sugar Gliders), to determine if this is feasible in terms of suitability. A total of 216 individuals were found who kept 1463 Sugar Gliders between them to participate in this study. Based on a questionnaire sent to participants, it was found that Sugar Gliders are a suitable species to be kept as a companion animal in terms of twelve criteria, including: how people interact and bond with Sugar Gliders as pets; the demands they place on owner's time and resources; and animal welfare issues. These results open the way for further research and large scale trials toward establishing a companion animal industry involving Australian marsupials.

ESTUARY CLASSIFICATION IN CENTRAL JAVA: TOWARDS A SUSTAINABLE COASTAL RESOURCES MANAGEMENT SYSTEM

CES 17

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Abstract
An estuary classification scheme is being developed for Central Java to underpin a broader study on the improvement of Sustainable Coastal Resources Management. The aims of this study are 1) to develop an estuary classification system for Central Java, 2) to apply this scheme to soil and resource mapping; and 3) to foster adoption of the scheme in environmental decision making processes and the development of land capability schemes for aquaculture and other coastal land uses. Remote Sensing, GIS and field/laboratory investigations were used to collect and analyse multi-level remote sensing (Landsat and Quick Bird), and hydro-geomorphologyt and soil data.

The results show that the low energy of the Java Sea on the north coast has developed river- and tide-dominated estuaries. In contrast, the estuaries located in the south coast are influenced by high energy waves and currents of the Indian Ocean and river flows, and are classified as wave-dominated estuaries. There is also uncommon estuary type, described as a wave-dominated estuary with pre-existing barrier, which has not been identified in previous estuary classifications. This estuary classification has broader applications in coastal management and environmental decision making that protect and manage coastal area in an ecologically and economically sustainable way.

TARGETED FISH-STOCKING IN ESTUARIES: DO NAÏVE FISH UTILISE KEY HABITAT?

CES 18

Alexander Pursche and Matthew Taylor
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The University of New South Wales

Abstract
Re-stocking of fishes is used worldwide as a management technique for augmenting depleted fish populations. Success of fish stocking programs is dependent on a wide range of complex factors including size of fish, season, and site of release; but do naive fish recognise the same habitat of their wild con-specifics?

Release strategies known as targeted stocking whereby fish are released directly into suitable habitat from a boat have been proposed to minimise emigration from the stocking site, and maximise survival by providing ample food and shelter.

In order to monitor the success of targeted stocking, 14 juvenile hatchery reared mulloway Argyrosomus japonicus were fitted with acoustic transmitters and released with 200 con-specifics into the upper Georges River, NSW, where two release scenarios were tested 1) 'haphazard stocking', whereby fish are released from a convenient location (i.e. boat ramp) and 2) 'targeted stocking', whereby fish are released directly into habitat.

Fish released into habitat showed higher site fidelity, lower daily activity, and spent a greater proportion of time occupying suitable habitat than fish released at the shoreline.

Success of fish stocking is substantially improved by targeting release to high-quality habitats as it likely reduces predation rates and increases feeding efficiency.

SCIENCE AND SOCIETY

SS

EFFECT OF CHOLESTEROL DEPOSITION ON BACTERIAL ADHESION TO CONTACT LENSES

SS 1

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Abstract
Purpose: Contact lens surfaces can attract tear film components during wear. This study was designed to determine whether surface bound cholesterol could alter the number of bacteria adhering to a lens.

Methods: Contact lenses were collected from subjects wearing balafilcon A or senofilcon A lenses on a daily wear schedule using either a PHMB or Polyquad based disinfection system (N=30). Lenses were then extracted in chloroform:methanol (1:1, v/v) and cholesterol separated by thin-layer chromatography. Using a standard curve of cholesterol, the amount of cholesterol in extracts was estimated. Unworn lenses were soaked in solutions of cholesterol to achieve the same cholesterol loadings as were found ex vivo. Pseudomonas aeruginosa 6294 or Staphylococcus aureus 31, at 1x107 CFU/mL in PBS, were added to the soaked lenses and incubated for 24h. Numbers of bacteria adherent to lenses were recovered and counted by plating method.Results: 3.2 ± 0.2 µg/lens cholesterol was removed from ex vivo balafilcon A lenses irrespective of solution used. For senofilcon A lenses with the PHMB solution, 2.4 ± 0.2 µg/lens and with Polyquad solution 1.0 ± 0.1 µg/lens cholesterol was extracted ($p<0.05$). The amount of cholesterol in vitro adsorption onto balafilcon A (3.2 ± 0.2 µg/lens) was similar to that of senofilcon A lenses (3.3 ± 0.2 µg/lens) under the same cycling conditions. For P. aeruginosa and S. aureus, there was no difference between adhesion on cholesterol-soaked or unsoaked lenses.

Conclusions: Whilst cholesterol has been shown to adsorb to contact lenses during wear, this lipid does not appear to modulate bacterial adhesion to a lens surface.

APPETITIVE TO AVERSIVE COUNTER CONDITIONING

SS 2

Helen Nasser and Gavan McNally
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Abstract
General motivational theories argue that excitors and inhibitors of opposite motivational states are functionally equivalent. It is thought that these motivational states are mutually inhibitory. Evidence for this arises from the demonstration of counterconditioning. Thus this experiment examined counterconditioning through appetitive to aversive transfer. During phase one, rats were trained to associate a CS with food and then footshock in phase two. The results demonstrated that when the CS was initially paired with food the acquisition of fear, as measured by increased freezing, head jerking and magazine responses were retarded. This is in accordance with the previous demonstrations of counterconditioning (Bouton and Peck, 1992). This impairment upon fear learning will be discussed in terms of associative and motivational learning theories. Further research is assessing the role of the lateral habenula in counterconditioning.

THE EYEMAPPER – THE CRYSTAL BALL OF MYOPIA PROGRESSION

SS 3

Cathleen Fedtke and Klaus Ehrmann
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The University of New South Wales

Abstract
Short-sightedness, or myopia, affects the lives of 1.6 billion people worldwide and is increasing rapidly, particularly in Asia. The research efforts to control the progression of myopia are intensifying. Recent animal studies suggest that the peripheral eyeball shape affects myopia progression. Currently, there are no reliable instruments available to measure this crucial parameter, or its equivalent – the peripheral refraction. Clinical instruments, currently in use, are designed to measure the eye's central power and thus require modifications to measure the periphery. This results in excessive testing time and alignment difficulties, which can lead to significant measurement inaccuracies. This PhD introduces the "EyeMapper", a novel instrument concept that maps the central and peripheral optical power of the eye efficiently and accurately. A narrow light beam is scanned in less than one second across the visual field, entering the eye from 11 different angles. This is achieved with an intricate arrangement of optical components and one scanning mirror. The 11 spots projected onto the retina are back-scattered and generate reflection beams containing the information of the power of the eye at each of the 11 positions. Each reflection beam is captured and analysed to generate the eye's power map. The EyeMapper provides precise and rapid measurements, which are crucial to predict, treat and monitor myopia progression.

CAN SILVER BE A REASON... FOR HEALTHY VISION?

SS 4

Jaya Dantam and Professor Fiona Stapleton
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The University of New South Wales

Abstract
Contact lenses are worn by 125 million people worldwide to correct vision and as an alternative to spectacles or refractive surgery. Infection of the cornea (microbial keratitis) is a rare but potentially sight threatening complication of contact lens wear. Often the storage case, where contact lenses are stored and disinfected overnight, is the source of microorganisms which can cause infection. The aim of this project is to improve the safety of contact lens wear by examining how effective some recent innovations are, in reducing microbial contamination of contact lens storage cases. Anti-bacterial storage cases impregnated with silver have been introduced into the market recently, to maximise the efficacy of the disinfection process. Limited information is available about how these cases work and whether they are effective when used in the community. This project describes both in-vitro and in-vivo performance of these antibacterial storage cases and has discovered some intriguing findings about how these new innovations work and what recommendations we can make to contact lens wearers about how to best look after them.

WHY DO THEY ALL LOOK THE SAME TO ME? INVESTIGATING THE MECHANISMS BEHIND THE OWN-RACE BIAS IN FACE RECOGNITION

SS 5

Kirin Hilliar and Dr Richard Kemp
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Abstract
The own-race bias refers to the general tendency for people to be better at recognising faces from their own racial group compared to faces from other racial groups. This is an incredibly robust effect in face recognition however debate continues about just what the primary mechanisms driving this effect are. Some researchers argue from a perceptual-expertise perspective: that we are better recognising own-race faces because we have had more practice learning how to process them; with sufficient practice with other-race faces, we could be just as accurate. Other researchers argue a socio-cognitive theory that the own-race bias reflects a more general tendency to favour in-group members, and that it is our tendency to see other-race faces as out-group members that leads to an unconscious decision to process these faces in less detail. My research is focussed on looking at the interactions between these two theories, and investigating their relative roles in eliciting the own-race bias, using a variety of different methodologies. Understanding these mechanisms can have important implications for issues as varied as understanding the reliability of cross-race eyewitness identifications, to increasing people's willingness to converse with other-race people.

TRIAL FRAME APPARATUS (TFA) FOR USE IN THE EVALUATION OF INTEROCULAR INTERACTIONS

SS 6

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Abstract
Interocular interactions may play a role in the development of anisometropic amblyopia. Shutter goggles are found to be successfully used in evaluating these interactions in children. However, they are not accepted by some parents in China. This study aims to design a new viewing system (TFA) to evaluate these interactions and to examine the agreement between this and the shutter goggles. The TFA was made with a pair of trial frame and three lenses: an opaque cover lens, a pinhole (1 millimeter diameter) lens and a partial occluder. Five designs of partial occluders were tried on 6 normally sighted adults and the one can engender the strongest interocular interactions was chosen. Agreements between the TFA and the shutter goggles in evaluating interocular interactions for low contrast visual acuity, contrast sensitivity and alignment sensitivity were then examined in 10 young adults and 10 children with normal vision, 14 anisometropic children without amblyopia and 14 anisometropic amblyopic children. Good agreements are found between the TFA and the shutter goggles in evaluating interocular interactions for all three visual functions, in all groups of subjects. Therefore, TFA is considered a reliable and satisfactory viewing system in evaluating interocular interactions.

THE EFFECT OF BENZODIAZEPINES ON INITIAL EXPOSURE TREATMENT AND TREATMENT FOLLOWING RELAPSE: AN ANIMAL MODEL

SS 7

Genevra Hart and Fred Westbrook
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Abstract
Anxiety disorders, such as phobias are highly prevalent in today's society, they are also chronically relapsing conditions. The major psychological treatment for anxiety is exposure-based therapy, where the patient is exposed to their feared situation in the absence of danger. These exposures will reduce the patient's fear, until it is no longer debilitating. Patients are often treated with anxiety reducing medication in combination with exposure therapy, and one of the major treatments are benzodiazepines, such as valium. My research focuses the effect of benzodiazepines on exposure-based therapies, using an animal model of anxiety. I have found that administration of benzodiazepines in combination with initial exposure therapy undermined the effectiveness of the therapy, however once relapse has occurred, the combination of therapy with a benzodiazepine improves the effectiveness of the treatment. This research suggests that patients suffering from anxiety disorders should undergo initial psychological treatment in the absence of benzodiazepine medication, but if relapse occurs, benzodiazepine treatment should compliment, and even improve the effectiveness of subsequent therapy.

THE EFFECT OF SHOULDER PADDING IN RUGBY TACKLES

SS 8

Juliana Usman and Associate Professor Andrew McIntosh
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The University of New South Wales

Abstract
The high number of shoulder injuries in rugby has been attributed to the tackle as the main mechanism of injury but the relationship of the forces in the tackle and the mechanisms by which the injuries occurs are not known. The objective of the study is to investigate the shoulder forces during the rugby tackle and the effect of shoulder padding. Twenty rugby players were recruited that met the criteria: 1) age between 18 – 25 years old, 2) have played at least 3 years of rugby season, and 3) have played at least a season of rugby within the last 3 years. A tackle bag weighing 45kg was use in the study and instrumented with a forceplate designed at UNSW comprising of 4 ELF Tekscan sensors sandwiched between two wood plates. Each participant performed 20 tackles in total in counterbalanced order. IRB approved shoulder pads were used in the study. The results showed that the average impact force for tackling without wearing shoulder pads was 1419 N against 1336 N for wearers. The shoulder pads reduced the peak impact forces by 6%. While there is a statistically significant reduction in shoulder force, this is not significant from an injury biomechanics perspective.

CONTEMPORARY OHS PRACTICES; HOW FAR HAVE IMPLEMENTATION, COMPLIANCE AND/OR ENFORCEMENT [I.C.E.] COME SINCE 1972; UK/AUSTRALIA?

SS 9

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Abstract
Currently, developed societies have a better grasp of the enormity of information technology available to them at a click of a button [e.g. world-wide web; not all is authoritative] thus, OHS has become more so transparent. However, for most of the 20th Century these laws were prescriptive in nature [Gunningham, 1996]. It was not until the early 80s that New South Wales Parliament was the first of the States and Territories Parliament to fully adopt a Robens approach to occupational health and safety since its development in 1972 when Parliament enacted the Occupational Health and Safety Act [1983] [McCallum, Hall, Hatcher et al, 2004] which operated alongside the industrial legislation, Australia. And by the mid 90s, it was clear that the OHS 1983 statute was in need of an overhaul again [Shaw and Searle, 1995]. And again, in 2008, Julia Gillard [MP]; the Minister for Employment and Workplace Relations announced the commencement of a national review into Australia's OHS Laws [Hansard, 2008]; a self-repeating history. Therefore, the safety of workers cannot be guaranteed through legislative practices or can they be through better I.C.E. applications?

EWW, GROSS! DISGUST IS RESISTANT TO EXTINCTION: IMPLICATIONS FOR THE TREATMENT OF ANXIETY DISORDERS

SS 10

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Abstract
Anxiety disorders have traditionally been conceptualised as involving maladaptive fear responses. However, there is growing awareness that dysfunctional disgust responses play a key role in certain anxiety disorders, such as phobias of blood and spiders as well as obsessive compulsive disorder. That is, people with these disorders aren't just afraid, they also experience high levels of disgust towards feared objects and situations. Indeed, in many cases, the disgust response is more prominent than the fear response. The "gold standard" treatment for anxiety involves gradual exposure to feared stimuli and situations. Although exposure is effective in reducing fear responses, little is known about its efficacy in targeting disgust responses. My research examines this important issue using a laboratory model of exposure (extinction). My research indicates that unlike fear, learned disgust reactions are resistant to extinction, as indexed by both self-report and an objective behavioural measure (visual avoidance). That is, despite extinction, disgust responses do not decrease. This innovative research suggests that exposure treatments for anxiety may not adequately target disgust reactions. This inattention to disgust may reduce the effectiveness of treatment or leave the patient vulnerable to relapse in the future. Potential strategies for treating excessive disgust responses are being explored.

THE EFFECT OF RISK - TAKING PROPENSITY OF CONTACT LENS WEARERS AND PRACTITIONERS ON CONTACT LENS PRACTICE IN AUSTRALIA

SS 11

Nicole Carnt and Professor Fiona Stapleton
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The University of New South Wales

Abstract

Purpose: To determine whether risk-taking propensity affects contact lens (CL) related attitudes and the behaviour of wearers and practitioners.

Methods: Practitioners were asked to enrol up to 10 current CL wearers each. Practitioners and wearers were surveyed for risk-taking propensity and behaviour associated with microbial keratitis risk factors (such as poor hygiene). Non-compliance was scored according to wearer reported behaviour and rated subjectively by practitioners. Practitioners also rated the influence of risk factors on their prescribing and wearer education practice. Associations were investigated using Pearson correlation.

Results: Higher wearer risk-taking (n=69) was associated with overall non-compliance ($p=<0.01$), less lens disinfection ($p<0.01$) and less lens case hygiene ($p<0.01$). Non-compliance of wearers as perceived by practitioners (n=68) was not associated with wearer reported non-compliance ($p>0.05$). Practitioners with greater risk taking propensity saw more wearers per week ($p=0.02$) however prescribing behaviour ($p=0.9$) and wearer education ($p=0.7$) was not different compared to less risk-prone practitioners.

Conclusion: Higher risk-taking CL wearers tend to be more non- compliant. Practitioners with higher risk-taking propensity prescribe contact lenses to more patients than practitioners who take fewer risks; however, prescribing patterns are similar. Importantly, risk-taking propensity is a better predictor of non-compliance in contact lens wearers than practitioner perception.

CONTACT LENSES: A FRIEND OR A FOE?

SS 12

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The University of New South Wales

Abstract

Contact lenses (CL) are an important part of day-to-day life for 140 million people worldwide. The importance of ensuring the safety of CL is paramount. Technology has come a long way since the advent of CL, with products such as breathable lenses that allow for overnight wear now being on the market. Despite these improvements, the risk of serious infection is still a concern. This project therefore set out to understand how CL wear changes the surface of the eye to increases its susceptibility to infection. In order to do this, we explored the changes in a protein known as MMP-9, which, when present in excess amounts, is capable of creating an open wound, or erosion, and hence exposing the eye to bacteria and therefore infection. We collected the tears from 38 healthy non-CL wearers over a 24-hour period to establish how CL affect the behaviour of this potentially harmful protein. After the first night of CL wear, MMP-9 concentration doubled in the continuous wear group, whilst there was no change in daily wear. Yet, by one month later, these effects had disappeared. This behaviour may explain why new CL wearers have an increased risk of sight threatening corneal infection.

LEARNING FROM NATURE – HOW DOES BONE FAIL?

SS 13

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The University of New South Wales

Abstract
Cortical bone, like many other natural materials, has a complex hierarchical structure. It uniquely combines brittle-like mineral crystals and soft-compliant organic matrix at different length-scales and orientations that gives a stiff and tough material.

The aim of this study is to investigate the failure mechanisms of bone at four different material levels: (1) the atomic level (mineral crystal phase); (2) the nano level (collagen fibrils), (3) the micro level (lamellar structure); and (4) the macroscopic level (cortical bone). This was achieved by a combination of techniques: high-energy X-rays, nanoindentation testing, and transmission electron microscopy imaging, digital image correlation method, and mechanical models.

Materials at all length scales deform elastically before yielding. The mineral phase and the nanostructure of bone are the key features in providing stiffness. Large macroscopic strain level causes partial failure in the nano-structure. A higher material level takes over the deformation process, while accumulation of microcrackings eventually leads to failure. The longitudinal and lateral orientations have stiffening and toughening role respectively.

The better understanding of the structure-property mechanical relationship of the hierarchical bone structure can be the basis to enhance the research in biomimetics, developing new advanced materials, and more importantly to find solutions for orthopaedics problems.

PERIPHERAL REFRACTION AND ORTHOKERATOLGOY

SS 14

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Abstract
Myopia, or short-sightedness, is global health problem affecting at least one third of all persons over the age of 12. It is currently believed that the development of myopia is strongly influenced by peripheral, rather than central vision. Manipulating the state of defocus, or refraction, in the periphery of the eye has been proposed as a possible mechanism of slowing down or ceasing the progression and development of myopia. A potential mechanism whereby peripheral defocus can be modified is orthokeratology (OK), a procedure which involves wearing a specialised rigid contact lens overnight. The lenses change the shape of the anterior surface of the eye to correct mild to moderate degrees of central myopia well as modifying peripheral defocus in the direction which is believed to cease myopia progression and development. The aim of my research is to investigate peripheral refraction in different ethnicities in order to ascertain reasons why Asians have a greater propensity for myopia development. Furthermore, I will be examining changes in and relationships between peripheral refraction and anterior eye curvature changes after OK.

SOCIAL FUNCTIONING AFTER TRAUMATIC BRAIN INJURY: IDENTIFYING IMPAIRMENTS IN DECISION MAKING USING A NOVEL TASK

SS 15

Michelle Kelly and Professor Skye McDonald
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Abstract
Decision making forms an important part of our everyday lives and is commonly impaired after a severe traumatic brain injury (TBI). This study aimed to develop and pilot a social decision making task. The Social Gambling Task requires the participant to play a game of 'catch and throw' with four pseudo players, with the aim of 'winning as many throws as they can'. Two players are regarded 'good choices' as they return the ball at a probability of 60% or 30%; the other two players are 'bad choices', returning the ball at a probability of 10% or 0%. Data are presented for 19 adults with TBI and 25 control participants. Preliminary results indicate that control participants made better decisions than TBI participants, winning more throws overall ($t = 2.22$, $p = .032$). A significant interaction between group and choice type was observed with control participants making more good choices and less bad choices than the TBI group ($F = 13.45$, $p = .001$). This novel task may help elucidate the nature of poor social decision-making in TBI patients. Evidence for the reliability and validity of this novel task is currently being collected, including psychophysiological data.

AN ASSAULT ON SPEEDING: CHALLENGING CURRENT DRIVER TRAINING STRATEGIES TO REDUCE YOUNG DRIVER FATALITIES

SS 16

Prasannah Prabhakharan and Dr Brett R. C. Molesworth
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Abstract
Young drivers (15-29 years) throughout the world continue to be over-represented in motor vehicle accidents (WHO, 2009). A contributing factor to a large number of these motor vehicle accidents is speeding. Reducing young drivers' tendency to speed remains a challenge. In aviation, one method that has yielded positive results in improving pilots' risk management behaviour involves cognitively engaging pilots in the task (Molesworth, Wiggins, & O'Hare, 2006). Cognitive engagement allows the individual to actively make decisions about their performance by providing them with personalised feedback about their own behaviour. The main aim of the present research was to examine the utility of a training program where drivers are 'cognitively engaged' in the task, in order to reduce their tendency to speed.

Experiment 1 demonstrated that being 'cognitively engaged' during a driving task reduced speeding behaviour one week post training. Experiment 2 examined the mechanisms underpinning the behavioural change. Preliminary results suggest that the 'young driver problem' may be due, in part, to an inability to effectively process all the cognitive tasks necessary to drive safely. These results challenge current driver training strategies, which do not appear to adequately equip young drivers with the cognitive skills required to drive safely.

AEROTOXIC SYNDROME: 1950'S - 2010

SS 17

Susan Michaelis and Chris Winder
School of Risk and Safety Sciences
The University of New South Wales

Abstract
Use of synthetic engine oils in commercial and military aircraft and the use of unfiltered breathing air from the compressor, poses serious flight and health and safety risks to those exposed including passengers and crew. Extensive military and commercial industry knowledge of this unique hazard and the toxic effects of heating oils containing hazardous substances including organophosphates, dates back to 1950. The use of aircraft bleed air had been assumed to be acceptable so long as oils were not heated to extreme temperatures, however advanced turbine engines have seen engine temperatures rise with oils stressed to their limits. Exposure to contaminated bleed air is not new or rare and is expected as a feature of the design and operational function of using bleed air systems. Studies of aircraft air quality have been inadequate and cannot be used to suggest aircraft air is safe or healthful. Pilot surveys indicate a unique health hazard is emerging clearly documented and related to the aircraft environment. Features include both short and long-term adverse effects with a pattern of chronic ill health emerging. This issue has been downplayed by the airline industry and Governments to keep aircraft flying, rather than enacting solutions that are available.

HOLOGRAMS TO MEASURE EYE-SIGHT!

SS 18

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Abstract
Currently, to determine spectacle prescription, the patient looks at a letter chart through trial lenses of various powers placed sequentially in front of his/her eye in a phoropter, and compares the clarity of two successive views of the chart. This is slow, tedious, and requires expensive equipment. We use a single hologram that measures the spherical focussing error in one step by presenting the views obtained through several lenses simultaneously. These inexpensive, lightweight holograms will be valuable for vision screening.

In our pilot study, measurements obtained using the hologram compared well with measurements obtained using the phoroptor. I investigated differences in the vision of myopes and hyperopes viewing through the hologram and found that hyperopes tolerate more blur than myopes in recognizing letters.

To investigate the underlying cause for this difference we recorded in a hologram a standard chart used for vision test. Tests revealed that the multivergence nature of the target in the original hologram caused the difference in vision between hyperopes and myopes. I am investigating to see if these differences can be used to detect early development of hyperopia/myopia.

We have also come up with a method to measure the astigmatism of the human eye using holograms.

MULTI-WAY INTERACTIONS IN METAL-PEPTIDE SYSTEMS

SS 19

Rima Raffoul Khoury and Professor Brynn Hibbert
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Abstract
In metal-peptide systems, it is the interaction of amino acid residues with one another and with the metal ion that determines the ultimate structure and stability of the metal-peptide complexes. The system response is mainly controlled by the interactions of the influencing factors rather than the individual and independent effect of each factor. The aim of the project was to find the optimum sequences of amino acids for binding metal ions in a systematic study by developing an experimental design that can capture information about high-order interactions. Furthermore mathematical tools were developed to correctly model the obtained data, multivariate model of Generalized Multiplicative Analysis of Variance (M-GEMANOVA). Series of experiments were conducted on metal-peptide complexes in solutions. For selected metal ions M2+ a full factorial design for the combination of the 3 amino acids residues chosen from Gly, His, Glu was investigated. Potentiometric titrations and UV/Vis absorption were used to measure the binding constant and to determine the characteristics of metalo-peptide complexes in solution. ANOVA, GEMANOVA and M-GEMANOVA binding models were built by using the data obtained.

HUMAN PAPILLOMAVIRUS AND BREAST CANCER

SS 20

Vanessa Tan and Dr Noel Whitaker
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The University of New South Wales

Abstract
In (HPV-induced) cervical cancer, cellular transformation and maintenance of tumourigenic properties of the tumor cells is dependent on the continued expression of HPV-E6 and -E7 oncogenes. Recently, a number of reports have identified HPV DNA and the expression of the HPV-E6 oncoprotein in breast cancer specimens. If HPV is involved in the oncogenesis of these HPV-containing breast cancers and, therefore, HPV-containing breast cancer cell lines, then the transformed phenotype of these cells, including their continued proliferation, could be expected to be dependent on the presence and action of viral E6 and E7.

This project aims to determine if the inhibition of HPV-E6 and -E7 oncogene expression in HPV-containing breast cancer cell lines inhibits the transformed phenotype in these cells. HPV-E6 and –E7 expression will be inhibited by specific RNA interference (RNAi) silencing to demonstrate that HPV E6 and E7 oncoproteins are essential for transformation maintenance.

If a dependence on the transformed phenotype on HPV-E6 and –E7 in HPV-containing breast cancer cell lines were demonstrated, this would provide evidence that HPV is a high risk causal factor in some human breast cancers. Such a role for HPV in breast cancer provides the possibility of primary prevention of some human breast cancers with vaccination.

HUMAN PAPILLOMAVIRUS IS ASSOCIATED WITH HUMAN BREAST CANCER

SS 21

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The University of New South Wales

Abstract

Rationale

There is increasing evidence that high-risk human papillomavirus (HPV) is involved in cancers in addition to cervical cancer. Recently, a role of HPV in human breast carcinogenesis has been suggested, although a causal role is yet to be demonstrated. Several reports have identified HPV DNA in breast cancer specimens using standard polymerase chain reaction (PCR), which is criticised for its propensity for contamination.

Objective

We have used three different technologies, in situ and standard PCR, and immunohistochemistry to demonstrate the presence of HPV in human breast cancer tissue and human normal breast tissue.

Results

In this report, we demonstrate the HPV DNA in three human breast cancer cell lines using in situ PCR. We have also detected HPV DNA in 30% of fixed human breast cancer tissues and 18% of fixed normal breast tissues. Presence of HPV was reaffirmed through sequencing. HPV oncoprotein in breast cancer tissue was detected by immunohistochemistry. In addition, we also show similar oncogenic characteristic between HPV associated breast cancer and HPV-associated cervical cancer.

Conclusions

These data provide evidence for a causal role for HPV in some breast cancers. This would provide the possibility of primary prevention of some human breast cancers with vaccination.

PROMISCUOUS MALES PAY THE PRICE

SS 22

Lyndon Jordan and Robert Brooks
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Abstract

Why isn't the natural world a more promiscuous place? Especially for males, mating with a high number of partners results in the greatest reproductive success, so the rule should be the more the better, right? In fact, my research has revealed that males pay a significant cost of promiscuity that places an upper limit on the number of sexual partners they can have throughout their lifetime. By studying the sex lives of tropical fish, I have demonstrated that males who mate with a series of new females throughout their lives forgo essential life tasks, such as eating, in favour of sexual effort. These males pay a long term cost as well – they grow more slowly and to a smaller adult size, and tend to die more quickly. This is in contrast to males living with a single partner, who eat regularly, grow steadily throughout their lives, and live a long life. These costs reveal a natural limitation on promiscuous behaviour, previously undescribed in vertebrates, and provide a warning to humans who may wish for a more promiscuous existence.

THREE DIMENSIONAL KINEMATIC ANALYSIS OF THE ARABESQUE: IMPLICATIONS FOR INSTRUCTING CLASSICAL BALLET

SS 23

Rachel Ward and Associate Professor Andrew McIntosh
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Abstract
Elevated extension of one straight leg behind the body ("arabesque") is a signature movement of classical ballet. The aim of this study was to provide insight into the biomechanics of the "arabesque" by using an 8-camera Vicon motion analysis system to examine the joint kinematics that characterise the movement. Five professional (mean age 24.8 ± 5.5 years) and five non-professional (mean age 20.0 ± 1.7 years) female ballet dancers underwent three-dimensional full body kinematic analysis while executing an "arabesque" to maximum leg elevation. The average maximum sagittal plane leg elevations for the "arabesque" were 97° and 83° for the professional and non-professional groups, respectively. Two-sample t-tests were used to report that this statistically significant ($p=0.033$) 14° difference in peak leg elevation, was accompanied by 7° more hip extension ($p=0.050$), 8° more anterior pelvic tilt ($p=0.061$) and 7° more external pelvic rotation ($p=0.037$) for the professionals compared to the non-professionals. The increased external pelvic rotation demonstrated by the professionals contradicts the instructional phrases commonly used when teaching the "arabesque", thus questioning the suitability of some classical ballet teaching methods, and therefore the accuracy with which movement instructors can visually perceive the more subtle and refined characteristics of highly skilled movements.

THE ROLE OF ATTENTION IN PERCEPTUAL LEARNING

SS 24

Tony Wang and Associate Professor Chris Mitchell
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Abstract
Perceptual learning is a process whereby organisms learn to differentiate two very similar stimuli. For example, a novice wine taster will find two red wines varieties, cabernet-merlot and cabernet-shiraz, very difficult to tell apart, but continued experience with these two wines will render them distinct. The relative novelty explanation argues that exposures to these wines will render the common flavor (cabernet) less salient because it is experienced twice as often as either unique flavor (merlot and shiraz). The more salient unique features become easier to detect because they capture greater attention. Two experiments were conducted to examine the applicability of this explanation in perceptual learning with visual stimuli. Experiment 1 demonstrated that preexposure to two similar complex visual patterns, AX and BX, enhanced discrimination between them. Attention to the unique features (A and B), measured by recording participants' eye movements, was found to increase following preexposure. Experiment 2 suggested that this attentional process is not due to relative novelty of the common and unique features. Results showed that attention was greater for familiar unique features than for novel unique features. These experiments suggest that preexposure increase attention to the unique features, such that they become more salient than novel features.

NOTES

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