Faculty of Science
12 October 2019

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Science Student Research Conference

Foreword

The UQ Science Student Research Conference is an authentic conference experience, organised and run by students in the UQ Science Leaders Academy.

It is an opportunity for presenters to share their research endeavours, and for all attendees to share their enthusiasm for research and network with the student research community.

All students who have completed a science research component within their studies are invited to apply to present a short talk or poster, and prizes will be awarded. If you would like to present at next year's conference, make sure to apply early in Semester 2, 2020.

Attendance at the conference can be counted as a supplementary activity of the UQ Employability Award.

Photos from the conference will uploaded to a Google Drive folder after the event, available at bit.ly/SSRCprogram19.

Thank you for joining us, we hope you enjoy the day.

17th UQ Science Student Research Conference Organising Committee

Jack Hill, Chair
Montana Samantzis, Treasurer
Jarred Van-Tent, Secretary

Schedule

0845 – 0930 Registration

0930 – 1100 Session I: Poster presentations and morning tea
1100 – 1115 Welcome address
1115 – 1230 Session II: Oral presentations

1230 – 1330 Lunch

1330 – 1445 Session III: Oral presentations
1445 – 1530 Networking and afternoon tea
1530 – 1615 Keynote and awards

Session I: Poster presentations

SCIE1200 Introduction to Science Research

P1. Bio-engineering Yeast for Commercial Use
Enzo Garoia, Vivian Chen, Samira Allouche, Zheng Gong

P2. How do artificial sugars mimic the taste of natural sugars without the calorific value?
Isabella Bernard, Isis Taylor, Tom Wilson-Gerrett, Naran Gillies

P3. Threats to Coral Reef Systems
Tanika Duivenvoorden, Eva Holden, Caeli Zahra, Thomas Todd

P4. 3D Printing in Biomedical Contexts
James Dann, Johannes Faller, Elizabeth Keir, Damica Laurie

P5. Telomere-lengthening: a potential antidote to biological aging and age-associated diseases?
Xiaofan Xu, Kurt Enkera, Thomas Greening

P6. What chemicals contribute to beer taste?
Julia Buczynski, Jessica Devenport, Joseph Pincus

P7. How are exoplanets discovered?
Kirby Fahy, Zoe Ilka, Tiger Murray

P8. Why do jokes become unfunny? - a cognitive neuroscience perspective
Tobias Massang, William Gunn, Elaina Coleborn, Elena Ninkovic

P9. The current and future impacts and applications of yeast
Julia Huang, Caitlin Rapson, Harry Roberts, Jayden Webster

P10. The Future Looks Bleach: the adverse effects of climate change on coral reefs
Ben Bloom, Marissa Riggs, Ceri Vaughan, Deekin Dametto

P11. Boozy Bucha
Lucy Clarke, Talitha Grootenboer, Eloise Tighe

P12. Tissue Engineering and Modern Medicine
Isabel Courtney, Eden Devon, Jebranca Spies, Emily Yuan

P13. The Ubiquity of the Harmonic Oscillator
Jack Bloomfield, Andreas Brachold, Konstantin Lakic, Will Gavin

Session I: Poster presentations (cont.)

P14. Managing grazing and sediment yields on the Great Barrier Reef
Brodie Crouch, Jackson Lucas, Bailey Deagon

P15. What Shape is the Universe?
Jack Bertoia, Khristine Vandellon, Ethan Makaresz

P16. Data transfer with Optical Fibres: Theory and Application
Karlym Nam, Hannah Tompkins, Thomas Quinn

P17. Regulation of Rate of Protein Synthesis and Function
Lachlan Curran, Brooke Sheehan, Jem Oliver

P18. What ethical issues arise when testing animals pain responses?
Isaac Kanowski, Shweta Zachariah, Jackson Nugent

P19. Nano-scaffolding and its medical applications
Daniel Butcher, Aaron Cartwright, Caitlin Ross, Reagan O'Brien

P20. The Science Behind Replacement Heart Valves
Hayley Favelle, Riley O'Shannessy, Matt Jones, Jessica Morris

P21. Long-Term Potentiation: Strengthening Connections in the Brain
Jacob Dyson, Leah Grundon, Matthew Kerr, Melanie Wu

P22. Windows into our climate-changed future
Jackson Barton, Laura Harms, Dhruv Jani, Gregory Stevens

P23. The Chaos Before the Storm
Flynn Cassells, Oakleigh Wilson, Aiden Harris

P24. Molecular Basis of Human Blood Typing, Rejection and Donation
Oscar Delaney, Braden Jericho, Serene McCormack, Stefano Di Iorio

P25. What happens when bone implants go wrong
Nick Rohland, Bianca Naumann, Fletcher Hood Withey, Alarna Leonard

P26. The neuroscience of addiction
Benjamin Mitchell, Hayden Wirth, Benjamin Crawford, Natalie Dimichele

P27. Dynamical Systems, Machine Learning and Deep Sea Mining
Caelum Mackay, Hayden Whyte, Gabrielle Simpson

Session I: Poster presentations (cont.)

P28. Major exoplanet discovery techniques and their applications in astronomy
Louis Backstrom, Renee Oldfield, Jon Edwards

P29. How Biomaterials can be used to heal wounds
Kelli Brandis, Oliver West, Moses Wong

P30. Ouch! Why Do We Feel Pain?
Oisin Hayes, Kavindu Jayaweera, Joshua Peters, Caitlyn Tang

P31. Beer, Wine and Spirits - What's the Difference?
Isobel Ryan, Max Orchard, Thomas John, Changxu Li

Undergraduate

P32. Ultrafast Microscopy with Optical Concatenation
Ben Carew

P33. Simple Models for Spin-Transitions in Spin-Crossover Compounds
Matthew Johnson

P34. Inflammatory moderators of antidepressant response in treatment resistant depression
Tristan Houghton

P35. Optimising Ultrasound Assessment in Cardiac Function in Small Animal Models
Hugh Schroder

P36. Simplified larval morphology as a result of the evolution of oviparity in the demosponge *Xestospongia bergquistia*
Robyn Davies

P37. Back to the future: how the Holocene sea level highstand helps us predict the future of coral reefs
Stella Knief

P38. Can preimplantation genetic testing improve outcomes for patients with structural chromosomal abnormalities? A systematic review
Wilbert Wong

P39. The Role of Sox9 in the Endothelium
Benedict Loweke

Session I: Poster presentations (cont.)

P40. Fetal brain parameters are altered in a rat model of maternal hypothyroidism
Elliott Neal

P41. Validating the cellular target of a repositioned calcium channel inhibitor for Parkinson's disease
Caryse Fong

P42. Development of survey to understand the KAPs surrounding the use of secondary disinfection in the control of Cryptosporidium
Samuel Brown

P43. Similarities and Differences of Discretisations of the Logistic Differential Equation
Montana Wickens

P44. Design of an Extended Cavity Diode Laser for Analysing Rb85/Rb87 two-component Bose-Einstein Condensates
Liam Balaam

P45. Mutagenesis of HER2 may prevent trastuzumab-induced cardiac dysfunction
Sophie Watson

P46. Dynamic polarizability of macromolecules for single-molecule optical biosensing
Eloise Browne

P47. Profiling Atypical Anxiety in Parkinson's Disease
Elana Forbes

P48. Influence of loom position on visual habituation in larval Zebrafish
Tessa Mancienne

P49. Impact of SSTs on Coastal Meteorology Adjacent to the Great Barrier Reef
Sienna Blanckensee

P50. Karrikinolide: A new compound to promote growth in the Solanaceae family
Harry Cosgrove

P51. Integrating an inducible cell cycle reporter into safe harbour site of pluripotent stem cells
Sonja Drljaca

Session I: Poster presentations (cont.)

P52. Isolation and Characterisation of Secondary Metabolites from *Cymbopogon procerus*
Laura Wait

P53. Enriching and Sustaining Cancer Stem Cells with Polymer Nanoparticles
Yushu Gu

P54. Expressional and functional study of various genes found predictive of type 1 diabetes onset in at-risk children
Nikita Rosendahl

P55. Prognostic risk factors for pathologic scarring in patients with burns – a systematic review
Thuan Nguyen

P56. Redshift effects in entangled quantum particles
Shaun McAnally

P57. HER2 Mutagenesis To Prevent Trastuzumab Binding
Jonathon Bolton

P58. The Role of Nuclear Factor One X in the Development and Maturation of Ependymal Cells in the Central Nervous System
Ingrid Miller

Postgraduate

P59. Lactic Acid Fermentation of Green Seaweed *Ulva fasciata*
Christina Admantin

P60. Understanding the immunomodulatory effects of faecal microbiota transplant (FMT) intervention during stem cell transplantation
Yashaswini Janardhanan

Welcome address

Jack Hill
His Excellency, Youth Governor of Queensland
Chair, UQ Science Student Research Conference Organising Committee

Session II: Oral presentations

Undergraduate

T1. Development of a computational tool to model chemical reaction kinetics based on quantum mechanical data
Georgianna Berthaly-Martyn

T2. Profiling dog bite emergency department presentations in the Metro South Public Health region of Brisbane: epidemiology, treatment efficacy and geographical analysis of populations at risk
Alexander Pekin

T3. Modelling spin crossover chains
Lachlan Parker

T4. Utilising Whatman FTA card technology to identify cell free schistosome DNA in a mouse model
Madeleine Rogers

T5. Quantum Thermalization and Entanglement Entropy in the Ising Model
Liam Bond

T6. A Window to the Past or: How I Learned to Stop Worrying and Love Rooted Phylogenies
Thomas Hassall

T7. Development of a method to test vascular competency of *Fusarium oxysporum* f. sp. *cubense* subtropical race 4 (Foc SR4) in Cavendish banana (*Musa acuminata*)
Montana Hickey

T8. Investigating quantum gravity in neutrons
Germain Tobar

T9. Mitigating climate change through restoration of coastal wetlands in South-East Queensland
Tallis Baker

T10. The chicken or the egg: neurodegenerative disease and it's interplay with sleep
Jeremy Hunt

T11. The Influence of Magnetic Field on Argon Emission Spectra
Xiaoya Jin

Session II: Oral presentations (cont.)

Postgraduate

T12. Curcumin-based photosensitization as green treatment for the inactivation of Aspergillus flavus spores in peanuts
Nalukui Mukubesa

T13. Extraction of viruses from high turbidity water samples
Selene Cannelli

T14. Community Use of a Landscape Approach to Wild Dog Control
Emily McKechnie

T15. Effects of compost quality and application rate on soil biological properties and C sequestration
Massomeh Mirshokraie

T16. Testing the quality of barley (*Hordeum vulgare*) through Near-Infrared Spectroscopy
Cinthia Yoshida

T17. Textural Characteristics of Hydrocolloid Enriched Soy Yoghurt
Zhiyu Leng

T18. The stability and the efficacy of novel Dyn1-7 analogues at KOP receptors
Pancong Niu

Session III: Oral presentations

Undergraduate

T19. Traits and trade-offs: Australian rainforest plants display mixed adherence to seasonal drought response predictions
Jack Hill

T20. Determining the origin of O-type stars
Amy Lubrano

T21. Spatial distribution of latent activity in the neural circuits of developing zebrafish
Andrew Entwistle

T22. Student perceptions of group work in an undergraduate physiology course
Montana Samantzis

T23. Membrane-active antimicrobial peptides and their atomic-level interactions with a lipid bilayer
Solace Roche

T24. The optimisation of current fibre-optic systems in the classical and quantum regimes
Flynn Linton

T25. JAKSTAT signalling between mesenchymal stem cells and endothelial colony forming cells
Elysse Morris

T26. Blue space exposure and the implications for public health
Sian Chadfield

T27. Modelling beach erosion under sea level rise in the humid tropics
Oxana Repina

T28. Partial haematopoietic stem cell depletion using c-kit-antibody-drug-conjugates allows targeted depletion and potentially safer autoimmune diabetes treatment
Huyen Nghiem

Keynote and awards

Professor Elizabeth Coulson
Faculty of Medicine, School of Biomedical Sciences,
Deputy Head of School, Chair Research Committee
Queensland Brain Institute, Clem Jones Centre for Aging and Dementia Research

Awards
People's Choice poster

Best SCIE1200 poster
Best undergraduate poster (individual)
Runner-up undergraduate poster (individual)
Best undergraduate 10 minute oral presentation
Runner-up undergraduate 10 minute oral presentation
Best undergraduate 3 minute oral presentation
Runner-up undergraduate 3 minute oral presentation
ASPinS 3rd year student prize

Best postgraduate poster
Runner-up postgraduate poster
Best postgraduate 10 minute oral presentation
Runner-up postgraduate 10 minute oral presentation
Best postgraduate 3 minute oral presentation
Runner-up postgraduate 3 minute oral presentation

P1.

Bio-engineering Yeast for Commercial Use

Group A1: Enzo Garoia, Vivian Chen, Samira Allouche and Zheng Gong

The University of Queensland

Yeast, *Saccharomyces cerevisiae*, is a single-cellular eukaryote which is commonly used for fermentation in alcohol manufacturing, and cooking. Yeast is also very efficient for bio-engineering due to its rapid growth-rate, and its structural similarity to mammalian cells. These benefits make yeast a prime species for bio-engineering compared to other organisms. Yeast is commonly used for drug production; one example of such is the production of insulin. The yeast cell can be injected with the genes of the appropriate drug, and the redundant yeast genes can be extracted, such that the efficiency of the drug production is maximized. Its structural similarity to mammalian cells allow yeast to be genetically modified with drug genes for an efficient oral administration of drug treatments to humans. It is very possible that yeast could be the future for medicine.

P2.

How do artificial sugars mimic the taste of natural sugars without the calorific value?

Group A2: Isabella Bernard, Isis Taylor, Tom Wilson-Gerrett and Naran Gillies

The University of Queensland

Excessive sugar consumption is widely accepted of the cause of many health issues, but most of us love the taste far too much to consider cutting it out of our diet. The ideal solution, then, is a substance that tastes sweet, but has no calorific value. Several of these artificial sugars have become widely accepted over the past 50 years, two being sucralose and aspartame. Sucralose is a derivative of sucrose, with three of the hydroxyl groups changed to chlorines. This chemical alteration causes it bind better to taste receptors, but is not recognisable to digestive enzymes. Aspartame is synthesised from two amino acid units, which binds to a specific taste receptor, and is broken down into those amino acids and their residues, providing a small amount of energy. Our research lead to a flaw in our question – there are natural sugars that are not metabolised, known as rare sugars because they occur in such small quantities. We concluded that there are many ways in which a molecule may have great affinity for taste receptors but be unrecognisable for digestion, or only low calorific value when broken down.

P3.

Threats to Coral Reef Systems

Group A3: Tanika Duivenvoorden, Eva Holden, Caeli Zahra and Thomas Todd

The University of Queensland

We often hear about the widespread effects of Global warming on our planet, but sometimes lack the compilation and analysis of these effects on ecosystems and nearby human populations. Coral reefs play a vital part in coastal protection from erosion and provide shelter and habitat for many marine organisms. Increases in ocean temperatures and prolonged abnormal thermal events due to global warming have led to coral bleaching and reef flattening. When water temperatures rise, the symbiotic relationship between coral and algae becomes stressed, and the algae is expelled from the coral, leaving it bleached and vulnerable to mortality. With bleaching events comes the flow-on effect of reef flattening, where coral breakage leads to a loss of calcification and the degradation of the reef's complex architectural framework. The impact of this loss in structure on marine life is extremely detrimental, as the damaged ecological niche lacks sufficient environmental refuge from predators and other abiotic stresses. Without the structural integrity of coral reefs to dissipate the energy of waves, shoreline areas are at a higher risk of erosion, flooding, and in extreme cases, the impact of tsunamis. Given that a large number of the human population live along the coastline, protecting these reefs from the onslaught of climate change should be of high priority in order to preserve our marine life and maintain a stable coastal environment.

P4.

3D Printing in Biomedical Contexts

Group A4: James Dann, Johannes Faller, Elizabeth Keir and Damica Laurie

The University of Queensland

Recent advances in 3D printing have led to the ability to print biological tissue with potential medical applications. Relatively simple structures such as cartilage and skin have been created, with hopes of more complex structures being produced. However, there exist many issues preventing these techniques being used for their desired purpose. The reproduction of a functioning vascular system remains a problem of significant interest, alongside speed, precision and cost.

Attempts to solve these issues include developing more compatible bioink to print smaller vessels and creating faster printers. In addition to the scientific challenges associated with bioprinting, the ethical issues surrounding this topic also raise further questions regarding the use of this technology in the future. This poster provides a brief summary of current progress and problems in biomedical 3D printing, alongside ethical issues that have been raised with the technology.

P5.

Telomere-lengthening: a potential antidote to biological aging and age-associated diseases?

Group A5: Xiaofan Xu, Kurt Enkera, Thomas Greening

The University of Queensland

As a eukaryotic, multicellular organism ages, its cells repeatedly divide. After a certain number of cell divisions, cells are susceptible to becoming senescent, meaning cell division is no longer possible. Cellular senescence is necessary as it prevents cells from acquiring unwanted degradation. However, it is also a key factor responsible for biological aging and age-related diseases. Contemporary research suggests that lengthening the telomeres which, after becoming critically short, trigger cellular senescence, can stave off senescence. Lengthening telomeres such that cell division can occur indefinitely, however, seemingly carries risks of cancer. Thus, contemporary research suggests that lengthening telomeres in a way which ensures that a permanent state of cellular senescence is avoided, while also avoiding indefinite cell divisions, could potentially be used as a therapy to thwart biological aging and age-associated diseases in eukaryotic, multicellular organisms

P6.

What chemicals contribute to beer taste?

Group A6: Julia Buczynski, Jessica Devenport and Joseph Pincus

The University of Queensland

The taste of beer can vary immensely among different brands and brewing origins. This is due to a vast amount of factors, beginning from the initial chemicals present in the mixture as well as how the beer is processed, and how long the processing takes at certain temperatures. The main chemical contributors to taste are esters (fruit-like flavours/aromas), alpha and beta acids (bitterness) and essential oils (aromas). The chemicals that give beer its unique taste are produced by three main components of beer which include, the barley which is the grain used, the hops which are the fermentation agent and the main producer of bitter flavours, and lastly the yeast which is what produces the alcohol and esters by consuming the sugar and proteins from the hops and barley.

P7.

How are exoplanets discovered?

Group A7: Kirby Fahy, Zoe Ilka and Tiger Murray

The University of Queensland

Exoplanets are planets beyond Earth's solar system. Over the past few decades over four thousand exoplanets have been discovered using multiple different discovery methods. The aim of this research was to describe how exoplanets are discovered. The five most prominent methods of discovering exoplanets; Radial Velocity, Transient Photometry, Microlensing, Astrometry and Direct Imaging were described and the different information they provide about exoplanets noted. In the search for a planet that could support life all methods are required as well as the development of new ones.

P8.

Why do jokes become unfunny? - a cognitive neuroscience perspective

Group A8: Tobias Massang, William Gunn, Elaina Coleborn and Elena Ninkovic

The University of Queensland

A joke's inevitable comedic downfall has roots in cognitive neuroscience. All fundamental elements of a joke — the effect of humour through surprisal, arousal, appropriate incongruity and joke constructs — result in a regular, unique brain activity pattern. The increased activity in the limbic system, specifically the amygdala and hippocampus, indicates a strong emotion underlying in the laughter response. Evolutionary, it has been theorised laughter signals the inhibition of the fight and flight response in others. As a result, stimuli that is emotional in nature, intensifies episodic memory, increasing the likelihood of the formation of an engram. This is to aid survival. Repeated retrieval of engrams that are useless to survival (ie the repetition of a joke) resultantly decreases brain response, making the joke become no longer funny.

P9.

The current and future impacts and applications of yeast

Group B1: Julia Huang, Caitlin Rapson, Harry Roberts and Jayden Webster

The University of Queensland

Yeasts are eukaryotic organisms whose 1500 species form roughly 1 percent of the fungus kingdom. The organisms are found throughout nature, abundant in sugary mediums such as nectars and fruits, or on the bodies of animals. They reproduce asexually through budding, where bumps protrude from the parent cells, enlarge, mature and detach as healthy yeast cells.

Currently, yeast has proven itself applicable in many industrial processes, the most popular of which being food and alcohol production. Further from this, yeast also has applications in medicine, where metabolic engineering can develop yeast strains that produce biopharmaceuticals. Similarly, yeast also has uses in bioremediation (the treatment of contaminated material with microorganisms to breakdown pollutants) and in scientific research, as their eukaryotic structure resembles the eukaryotic cells of a human.

The yeast organism is applicable in all these situations due to their fermentation process. The yeast grows on carbon rich sources such as sugars and converts these carbohydrates into carbon dioxide and other industrial by-products (such as alcohols or acids, or in the genetic engineering case, any engineered chemical). This is achieved through many catalytic enzymes and chemical reactions better detailed on the poster.

To conclude, yeast has acted as one of man’s oldest industrial organisms and is applicable in many fields of industry. In future, current research has explored the potential uses of yeast in the production of dairy products, possibly eliminating the need for cattle-based dairy farms. Likewise, certain medicinal companies have developed strains capable of producing anti-malarial drugs.

P10.

The Future Looks Bleach: the adverse effects of climate change on coral reefs

Group B2: Ben Bloom, Marissa Riggs, Ceri Vaughan and Deekin Dametto

The University of Queensland

Our climate has always been dynamic. However, atmospheric and environmental changes produced by human activities are changing our climate at a rate much faster than previously recorded. Significant temperature changes, an increase in extreme weather events and acidification of our oceans, will see the collapse of many ecosystems unable to adapt sufficiently quickly. Currently, rising temperatures are the leading primary cause of coral bleaching and subsequently of significant concern to the survival of coral reefs. Coral bleaching occurs when the crucial endosymbiotic relationship between algae and coral is disrupted by rising temperatures, causing the coral polyps to expel algae. A particularly prominent case is that of the Great Barrier Reef. The reef protects the North-East Australian coast, is a major source of carbon storage and a host to one of the most biodiverse regions on the Earth.

P11.

Boozy Bucha

Group B3: Lucy Clarke, Talitha Grootenboer and Eloise Tighe

The University of Queensland

Kombucha is a tea based fermented drink, with a fermentation process similar to that of beer. However, kombucha is considered ‘non-alcohol,’ and the difference in ethanol in kombucha and beer is what gives them the ‘non-alcoholic and ‘alcoholic’ classifications respectively. The ethanol levels in kombucha and beer stems from the temperature at which the two drinks are fermented. Beer is fermented at a higher temperature than kombucha, which produces ethanol as a by-product, however this calls into question; what would happen if kombucha was left in hot conditions; could it start to produce ethanol and no longer be below the standard ‘non-alcoholic’ level? By focusing and extending on an Irish paper from 2016 that investigated the measurement of ethanol in five different commercial kombucha preparations, the effects of a temperature rise for kombucha will be further explored. Despite the paper not stating at what temperature the kombucha ethanol levels were tested, all five samples were found to be over the standard ‘non-alcoholic’ limit of 0.5% Abv. Hence, this demonstrates that kombucha can reach levels that should be classified as ‘alcoholic,’ posing risks for an uneducated consumer. There are many implications for such an issue; can this supposedly ‘healthy’ drink be made alcoholic or alternatively, could a drink with a similar taste to beer be created ‘non-alcoholic,’ providing a safe and enjoyable option for the designated driver?

P12.

Tissue Engineering and Modern Medicine

Group B4: Isabel Courtney, Eden Devon, Jebranca Spies and Emily Yuan

The University of Queensland

Tissue engineering seems like a façade only seen in fictitious shows television shows. But what if it was actually a possibility? Currently, in Australia alone, over 1500 people are anxiously waiting on an organ transplant to save their life, whilst the average time kidney donation recipients may have to wait is over three years (Kidney Health Australia, 2019). These statistics alone show the limitless potential of tissue engineering for improving so many lives, not only the patients but also their loved ones. Tissue engineering is an extremely multifaceted approach to medicine. The right scaffolding needs to be picked with an effective chemical nature and adequate physical properties – as to not degrade in the body, and the cell types that are chosen to be inserted into the scaffolding must have the properties to differentiate into their desired function and efficiently work in that part of the body. Tissue engineering is not only beneficial for reducing wait times for new organs, but also reducing the occurrence of rejection in the body, and the risk of the organ relapsing into the same disease. Overall, tissue engineering is a possibility in the very near future and it must be viewed from an interdisciplinary perspective of science.

P13.

The Ubiquity of the Harmonic Oscillator

Group B5: Jack Bloomfield, Andreas Brachold, Konstantin Lakic and Will Gavin

The University of Queensland

Over the past few centuries, various formulations of physics have been developed. The classical understanding of reality was described by Newtonian Mechanics. Subsequent reformulations of these classical ideas emerged with the development of Lagrangian and Hamiltonian Mechanics. This revealed an elegant mathematical framework which could describe reality in the classical domain. Such an elegant mathematical framework proved to be useful in the paradigms of modern physics, especially during the discovery of quantum mechanics. The progression of these paradigms in physics can be explored through the harmonic oscillator. Oscillatory phenomena can be found throughout the natural world, in classical and quantum systems. Many complex systems with periodic behaviour can also be described by the physics of a harmonic oscillator under certain conditions. Describing the harmonic oscillator with Newtonian, Lagrangian and Hamiltonian Mechanics provides valuable insights into the progression of classical physics and the mathematical elegance inherent in these descriptions. Accordingly, describing the quantum harmonic oscillator with the mathematics of quantum mechanics reveals aspects of the nature of reality at these scales. Moreover, the harmonic oscillator is a system which is ubiquitous in nature and ideal for examining the mathematics of paradigms in physics.

P14.

Managing grazing and sediment yields on the Great Barrier Reef

Group B6: Brodie Crouch, Jackson Lucas and Bailey Deagon

The University of Queensland

Australia's Great Barrier Reef (GBR) is one of the most unique and biodiverse ecosystems on the planet. Worth an estimated $56 billion to the Australian economy (Deloitte Access Economics, 2017), not only does the reef provide jobs, but also contains extensive areas of coral, sea grass and fish nurseries (Brodie et al, 2012). However, since European colonisation, the GBR has been under increasing anthropogenic pressure, particularly from increased sediment loads due to land use change (McCulloch et al, 2003). Whilst the negative impacts of the sediment have been well documented (Fabricius, 2005; Dikou and van Woesik, 2006; Phillip and Fabricius, 2003), the terrestrial aspect and that proportioning total sediment loads to each land use probably less so. We aim to describe changes to ecosystems as a result of grazing and the resultant impacts this has on sediment loads.

P15.

What Shape is the Universe?

Group B7: Jack Bertoia, Khristine Vandellon and Ethan Makaresz

The University of Queensland

As a consequence of the theory of General Relativity, space itself can be distorted. This raises the question: how curved is the space we live in? The main method to test this involves estimating the mass density of the universe and compare the resulting attractive force of gravity to the repulsive force of dark matter and observations of the expansion of the universe to calculate the curvature. Performing this calculation reveals that the universe is actually flat on average. This flatness can be explained by the theory of cosmic inflation, which assumes that the universe underwent an intense period of faster-than-light expansion which locally smoothed out the mass distribution of the universe.

P16.

Data transfer with Optical Fibres: Theory and Application

Group B8: Karlym Nam, Hannah Tompkins and Thomas Quinn

The University of Queensland

The essence of fibre optics is the guidance of light through a thin channel of a flexible glass or plastic fibre. This technique was first applied in the 1930s when a light-guiding plastic channel was used to image the inspection area in a patient at hospitals. Today, the technology of transmitting the information as light pulses is widely adopted in telecommunication such as data networking in on the internet. The theory of trapping light within a medium is based on the total internal reflection where light is fully reflected at the boundary of the medium without escaping. During data transfer, optical fibres transmit binary data as either a light pulse or an absence of a light pulse. As the data travels the fibre, the signal is attenuated due to several factors including the impurity of a glass, improper connection, and index-of-refraction mismatch, which can decrease the performance of the transmission. By tackling the challenges and the limitations of the fibre optics, we expect that the field of fibre optics continues to serve as the backbone of communication in the future.

P17.

Regulation of Rate of Protein Synthesis and Function

Group C1: Lachlan Curran, Brooke Sheehan and Jem Oliver

The University of Queensland

Protein synthesis relies on a series of complex biochemical processes. For any protein, its function depends on both its primary amino acid sequence, and the resulting form it takes via pleating, folding and other manipulations. We investigated the influence of the rate of protein synthesis on this final function via the influence of rare and common tRNA's. As each tRNA's anticodon matches with the codon triplet of the mRNA within the ribosome, it detaches its corresponding amino acid which joins the growing protein chain. If this tRNA is abundant in the cell, then this process runs smoothly and the protein synthesises as normal. However if this tRNA is rare, the synthesis is delayed, causing the protein to fold in a different manner.

P18.

What ethical issues arise when testing animals pain responses?

Group C2: Isaac Kanowski, Shweta Zachariah and Jackson Nugent

The University of Queensland

Testing animal pain response is important as it allows researchers to better understand how certain animals react, both physically and neurologically to harmful environments. This knowledge can then be extrapolated to people, meaning the human nerve and pain response systems can be better understood, allowing for more efficient implementation of pain reduction measures for both animals and people.

Some ethical issues do arise from this animal testing however, as, while humans are not harmed, in almost all cases, animals are subjected to harmful, often distressing environments. Furthermore, some animals' neurological systems do not perfectly correlate to people, meaning the effects of animal tests may not be the same as those in humans.

The positives and negatives of animal testing, alongside the current regulations that are in place, must be therefore considered to see if the benefits of pain testing outweigh the harm caused.

P19.

Nano-scaffolding and its medical applications

Group C3: Daniel Butcher, Aaron Cartwright, Caitlin Ross and Reagan O'Brien

The University of Queensland

Organ failure and tissue loss account for significant medical spending and time required to treat patients, with thousands on waiting lists for organ donors and treatment. Nano-scaffolding is a part of the field of tissue engineering which has shown rapid development, leading to applications for medical processes to regrow tissue and bone. These scaffolds consist of polymer fibres modified to mimic the native extracellular matrix and form three-dimensional structures which have shown to have more efficient effects on cell and tissue repair in comparison to traditional types of scaffolds. This engineering aspect alone is a multidisciplinary field which consists of multiple different approaches, however, they must all achieve the properties which allow and encourage cell growth without interrupting regular functions of the tissue. Furthermore, nano-scaffolding can be used to assist bone reconstruction, providing a better alternative option in comparison to previous techniques such as autografts and allografts when considering severe bone fractures. Additionally, nano-enabled approaches have been implemented and have been instrumental in the development of suitable scaffolding for therapeutic effects on repairing cardiac tissue to treat certain cardiac diseases.

P20.

The Science Behind Replacement Heart Valves

Group C4: Hayley Favelle, Riley O'Shannessy, Matt Jones and Jessica Morris

The University of Queensland

The heart plays a vital role in the successful function of the human body, and its structure plays a key factor in determining its efficiency. More specifically, the structure of valves inside the heart which control the movement of blood is vital to the entire process of circulation. If valves in the heart are not functioning correctly, circulation of blood in the body is compromised, leading to a range of dangerous and potentially fatal side effects, and in most circumstances, valves must be replaced. To address the problem of malfunctioning valves, replacement valves can be fitted in patients, with the two most commonly used types of heart valve replacements including mechanical valves and bioprosthetic valves. Mechanical valves are constructed using durable material such as titanium and carbon and are sewn into place onto the heart in the place of the original valve and are no longer used as a common treatment option today. On the other hand, bioprosthetic valves are constructed using biological material supported by a polymer scaffold and are regarded as a significantly safer treatment option in comparison to their mechanical replacement counterpart. However, both types of valve replacements have various advantages and disadvantages in prosthetic use, with continued research into these replacements essential to determining a safe and viable way of doctors treating damaged valves in patients.

P21.

Long-Term Potentiation: Strengthening Connections in the Brain

Group C5: Jacob Dyson, Leah Grundon, Matthew Kerr and Melanie Wu

The University of Queensland

Long-Term Potentiation is a process which occurs between neurons in the brain which allows us to form stronger neural pathways. This enables enhanced recollection of memories which are frequently revised. Our research group investigated whether this process may be manipulated in order to increase memory and whether it may increase our understanding of diseases such as Alzheimer's and processes which cause long-term memory loss in patients. We found research which suggests a positive correlation between navigational expertise and LTP production in a practical application of London taxi drivers. In addition to this, synaptic failures in the brain were found to inhibit the Long-Term Potentiation ability of neurons which directly lower the cognitive capability of the brain and thus develop Alzheimer's disease. We concluded that repetition of activation of neural pathways is the key to developing our neural pathways and to gaining a greater memory-recollection ability.

P22.

Windows into our climate-changed future

Group C6: Jackson Barton, Laura Harms, Dhruv Jani and Gregory Stevens

The University of Queensland

Dynamic models of climate change are used to inform scientists about how Earth's climate is changing and show how human activities drive climate change.
Ideally the models should simulate and predict climate characteristics and variability with sufficient fidelity to enable policy decisions to be made with high confidence. There are over 69 climate models, with more being developed. The models are regularly assessed and compared in the Coupled Model Intercomparison Project (CMIP), which is run by the Lawrence Livermore National Laboratory in the USA.

Climate models fall into two broad categories: the standard Atmosphere–Ocean General Circulation Models (AOGCMs) and the current state-of-the-art Earth System Models (ESMs) which build upon the AOGCMs by including biogeochemical effects of the carbon and sulfur cycles and ozone. A subset of the ESMs is Earth System Models of Intermediate Complexity (EMIC) which attempt to model idealized climate characteristics, or model at a lower resolution than the ESMs.

The strengths and weaknesses of these climate models are discussed, as are some features of a few models. These models are compared, and conclusions are presented pertaining to the significance of each model.

P23.

The Chaos Before the Storm

Group C7: Flynn Cassells, Oakleigh Wilson and Aiden Harris

The University of Queensland

One small change can have drastic effects on a system, the cliche example of this is the simple flap of a butterfly's wings one one side of the world can cause a cyclone on the other side. The mathematical phenomena of systems so volatile that such a seemingly insignificant event can cause such severe differences in outcomes is known as chaos theory. Chaos theory is often modelled using a system of differential equations, the most famous example of which is the Lorenz System with the ever popular ‘butterfly’ appearance of the chaotic curve when modelled in 3d space. No doubt the example of butterflies affecting the weather comes from the combination of the appearance of this curve and that one of the main practical applications of chaos theory is predicting the weather. There are many factors that influence the weather in any location at any given time, but due to the chaotic nature of it, should all these factors be measured to an almost obscene amount of accuracy, any attempt for prediction of the weather would be little more than a guess after the passage of time has amplified any uncertainty of the measurements.

P24.

Molecular Basis of Human Blood Typing, Rejection and Donation

Group C8: Oscar Delaney, Braden Jericho, Serene McCormack and Stefano Di Iorio

The University of Queensland

Many patients require blood transfusions after injury or infection, and so we must ensure that there is always enough blood of the right types to make this life-saving clinical procedure of transfusion possible. This demand for blood is not always met, and new sources of high-quality blood must be found. The ABO blood group system is the most important, and its molecular and genetic basis is now well-understood. The Rhesus factor is another important blood typing framework, particularly during childbirth. However, at all stages of life, if incompatible blood is injected into an individual, cellular mechanisms react to the foreign antigens, triggering a damaging immune response. There is a distinct hierarchy of usefulness of donated blood, from the universal donor O- all the way through to the universal receiver AB+, so the ability to artificially synthesise O- blood would be particularly valuable. Scientists have recently made progress on this front, by successfully converting type A blood into type O blood by removing certain antigens from red blood cells.

P25.

What happens when bone implants go wrong

Group D1: Nick Rohland, Bianca Naumann, Fletcher Hood Withey and Alarna Leonard

The University of Queensland

Bone implants are an incredibly important medical procedure that can allow people to recover from broken bones. Unfortunately, they are not perfect and there can be serious complications that arise. The long-term success of an implant is primarily determined by the material of the implant, currently the most used are alloys of titanium and stainless steel. Titanium implants are quite prone to rejection causing inflammation at the site of implantation. Research focuses on the production of alternative materials that reduce the chance of rejection. One prospective method is 3D printing an implant that has similar properties to bone minimising rejections.

P26.

The neuroscience of addiction

Group D2: Benjamin Mitchell, Hayden Wirth, Benjamin Crawford and Natalie Dimichele

The University of Queensland

Currently, 1 in 20 people suffer from addiction, mainly substance abuse. The American Society of Addiction Medicine (ASAM), currently defines addiction as “a primary, chronic disease of brain’s reward, motivation, memory and related circuitry”. The abuse of substances, such as alcohol and drugs, directly affects the reward system of the central nervous system. The substance targets a group of neurons in the brain called the mesolimbic pathway. When activated, this pathway releases dopamine, an essential neurotransmitter in the reward system. Substance use activates the mesolimbic pathway, resulting the release of dopamine. Our research focused on how consistent activation of the mesolimbic pathway, due to frequent substance use, leads to addiction. Overall, frequent substance abuse results in changes in the brain that contribute to addictive behaviours. These changes create powerful associations with environmental cues and substance cravings.

P27.

Dynamical Systems, Machine Learning and Deep Sea Mining

Group D3: Caelum Mackay, Hayden Whyte and Gabrielle Simpson

The University of Queensland

Dynamical Systems and machine learning are used extensively in industry for modelling purposes. Machine learning - a field accelerating in popularity - is often quoted as being incredible at modelling scenarios. On the other hand, dynamical systems is a more mathematical approach to modelling - a technique increasing in complexity the more variables added to a problem. However, both of these techniques have situations where they are not very effective in actuality. This poster investigates the situations where machine learning and dynamical systems are more effective for practical use. For scenarios where there is very little data available, it is more effective to use dynamical systems as a modelling technique. This is because machine learning is unable to sufficiently predict what will occur without lots of data to build a model on. Furthermore, using dynamical systems, one is able to create a model that gives a clear mathematical relationship between variables. This is often unable to be done with machine learning. In this sense, modelling with dynamical system presents a more fundamental approach to a problem. However, on the other hand, machine learning is often able to create more accurate models with sufficiently large pools of data, making it more practical then using dynamical systems to model. This relationship between dynamical systems and machine learning is explored in relation to several real world situations; and in conclusion, both methods have situations where they prosper and where they fail.

P28.

Major exoplanet discovery techniques and their applications in astronomy

Group D5: Louis Backstrom, Renee Oldfield and Jon Edwards

The University of Queensland

An exoplanet is a planet that orbits a star outside of our solar system. Exoplanets were first detected by astrophysicists Alexander Wolszczan and Dale Frail in 1992. They discovered three exoplanets orbiting around PSR B1257+12, a neutron star about 2300 light years from Earth. In the last 27 years, around 4000 exoplanets have been detected, and the rate of detection is increasing over time. There are many different methods that have been successfully used to discover these exoplanets; the three main methods used to date are radial velocity, also known as Doppler spectroscopy, transit photometry and gravitational microlensing. Until recently, the radial velocity method was the most successful way of detecting exoplanets before it was overtaken in number of discoveries by transit photometry. Gravitational microlensing is less commonly used than the other two methods, but it is useful for detecting low-mass planets or planets with a wider orbit when radial velocity and transit photometry methods would be ineffective. Although the use of each method is limited by various factors, they each have advantages that make them effective for detecting exoplanets.

P29.

How Biomaterials can be used to heal wounds

Group D6: Kelli Brandis, Oliver West and Moses Wong

The University of Queensland

Countless numbers of treatment options are available for cuts, grazes, burns and any other small injury, creating a billion-dollar industry worldwide. As technology advances, both natural and synthetic biomaterials have advanced to be applied in the medical field, in areas such as wound healing. Dressings with growth factors to facilitate healing and skin substitutes are just the beginning of the biomaterial field with great room for advancement. We have compared and analysed the latest advances for the use of biomaterials and discussed the possibilities for the future.

P30.

Ouch! Why Do We Feel Pain?

Group D7: Oisin Hayes, Kavindu Jayaweera, Joshua Peters and Caitlyn Tang

The University of Queensland

Pain is an experience that nearly everybody has to cope with daily. While pain is a normal occurrence, the mechanisms behind it are fairly complex is nature. Pain can exist in three distinct forms, nociceptive (physical) pain, neuropathic (internal) pain and psychogenic (mental) pain. These three forms of pain signal different problems with the body, yet all involve the brain and nervous system. Pain also varies in a range of different severities, which can range from the near undetectable to entirely lethal. This poster seeks to answer why pain is experienced in different ways and how the brain processes each individual pain event.

P31.

Beer, Wine and Spirits - What's the Difference?

Group D8: Isobel Ryan, Max Orchard, Thomas John and Changxu Li

The University of Queensland

Alcoholic beverages are made from a wide range of yeasts that ferment sugars into ethanol and carbon dioxide. Different strains of yeasts can produce different chemical groups that give these alcoholic beverages various distinct flavours. Saccharomyces cerevisiae is a strain of yeast that during fermentation produces a high concentration of ethanol, but low levels of flavour congeners such as esters, carbonyl compounds and organic acids. Saccharomyces bayanus is a more popular strain of yeast to use in fruity wines since it can produce larger amounts of esters that have fruity and floral flavours. Saccharomyces pastorianus is a hybrid of two other Saccharomyces species that is generally used to ferment lager beer by producing large amounts of the flavour components methyl butanol, ethyl acetate, and 3-methyl butyl acetate.

P32.

Ultrafast Microscopy with Optical Concatenation

Ben Carew and Professor Warwick Bowen

School of Mathematics and Physics, University of Queensland

Compressed ultrafast photography describes a variety of methods used to produce video footage with temporal resolutions on the order of trillions of frames per second. Such techniques can be used in a vast spread of research applications; of particular interest is fluroescence-lifetime imaging microscopy in experimental microbiology. To achieve high frame rates in a single shot, our approach is to optically transform the viewing image from two dimensions into one dimension. This allows us to sacrifice spatial resolution for faster frame-rates, by "stacking" many low-resolution frames into the space of a single high-resolution frame. We designed an optical system that takes light from a microscope objective to a CCD camera and transforms the image to a thin strip. The design uses cylindrical lenses that act on a single axis of the image at a time, and an "optical concatenator" which applies a displacement to each pixel of the image. We computationally modelled the optical system using fourier optics, and simulated the output image using a Kirchhoff diffraction model. These models have helped to confirm the validity of this approach to ultrafast microscopy, and fabrication of the optical concatenator will be the next step in this project.

P33.

Simple Models for Spin-Transitions in Spin-Crossover Compounds

Matthew Johnson and Professor Ross McKenzie

School of Mathematics and Physics, University of Queensland

Spin-crossover is a phenomenon in organometallic complexes involving the transition between low and high-spin states – dependent on the arrangement of d-orbital electrons into states which allow for the minimal and maximal quantity of unpaired electrons respectively. Physical properties, such as magnetism and colour change in this transition. The materials potential applications is primarily in electronics, specifically memory devices and optical displays. Theoretical models are key in understanding this phenomenon, but with large variation in spin-crossover behaviour as parameters such as temperature, pressure, and chemical composition are varied, a single model may have limited applicability. By distilling a simple model into relationships between their most essential parameters, it may be possible to more easily describe transitions in compounds that exhibit qualitatively different behaviours. Using an Ising pseudospin model, where the pseudospin describes the low- and high-spin states we sought parameterisation of qualitatively different spin-crossover curves as a function of temperature to see if such this single model could describe a wide range of materials. Overall, the model did a poor job in capturing the behaviour of both gradual and abrupt spin-transitions for materials where the high-spin fraction does not start at zero (at arbitrary temperature). In the case where it does, there was significant adherence to the experimental data.

P34.

Inflammatory moderators of antidepressant response in treatment resistant depression

Tristan Houghton, Blair Price, Dr Nathanael Yates and Dr Susannah Tye

School of Biological Sciences, University of Queensland

Nearly a third of patients with depression fail to respond to first-line treatments. This phenomenon of treatment-resistant depression (TRD) has an intimate, yet poorly understood relationship with chronic inflammation. To investigate this, we examined the antidepressant and anxiolytic effects of a novel drug which inhibits the inflammatory cytokine soluble tumour necrosis factor alpha (sTNFα) in a rodent model of adrenocorticotropic hormone (ACTH)-induced TRD. Male Wistar rats (n=117) were given saline or chronic injections of ACTH (100μg/day) for 14 days. They were then given saline or the anti-inflammatory drug (10mg/kg) one hour before behavioral tests. Forced swim test (FST), open field test (OFT) and elevated zero maze (EZM) were conducted. The rats were then culled, and measurements were made of TNFα and C-reactive protein (CRP) in plasma, and glutamate receptor 1 (GRIA1) expression in the prefrontal cortex. Further, the expression of glial fibrillary acidic protein (GFAP) indicating astrocytes was quantified via immunohistofluorescence. Compared to ACTH controls, treated rats had significantly reduced immobility times ($p=0.0198$) and increased latency to immobility ($p=0.0079$) during FST; decreased mobility ($p=0.0022$) in OFT; increased open arm time ($p=0.0103$) in EZM; and reduced TNFα ($p=0.0049$) and CRP expression ($p=0.0262$). Additionally, there was a positive correlation between GRIA1 expression and FST immobility ($p=0.0339$) and a negative correlation between GRIA1 and CRP expression ($p=0.0044$). The results of GFAP expression are ongoing and preliminary results will be presented. Collectively, these results suggest a relationship between sTNFα inhibition, down-regulation of inflammation, and antidepressant and anxiolytic efficacy in a rodent model of TRD.

P35.

Optimising Ultrasound Assessment in Cardiac Function in Small Animal Models

Hugh Schroder

An echocardiogram is an ultrasound image used to visualise the heart and assess its cardiac function. Assessment of mouse hearts poses a unique challenge with a small size and high heart rate (~600bpm). The Vevo3100 Preclinical Imaging System, recently acquired by SBMS, is tailored to small animal work, capturing high resolution, high frame rate images. Accurate and reliable image analysis is as important as the acquisition of the images, with the potential to introduce significant data variation. The aim of this study was to optimise echocardiography data analysis to improve the reliability of data acquired. Three scientists received training in echocardiography image analysis from multiple sources before independently performing an analysis of 11 hearts to generate four different measurements; ejection fraction (EF), fractional shortening (FS), early (e) and late (a) mitral valve flow (e/a), and annular wall momentum (e'a'). Initial analyses revealed a high degree of correlation in values obtained by different users for fractional shortening ($r^2 = 0.9729$), e/a ($r^2 = 0.9917$) and e'/a' ($r^2 = 0.7439$), however significant degree of variation was found in the Parasternal Long Axis mode causing a disparity in the Ejection Fraction values ($r^2 = 0.4217$). Following feedback and reconciliation of differences in image quality assessment and analysis methods, a second analysis was performed which revealed an improvement in all variables, particularly Ejection Fraction ($r^2 = 0.9215$). This corroboration between independent analysts now gives validity to this methodology, which is integral to all future investigations using ultrasound assessment at The University of Queensland.

P36.

Simplified larval morphology as a result of the evolution of oviparity in the demosponge *Xestospongia bergquistia*

Robyn Davies, Dr Claire Larroux and Professor Bernard Degnan

School of Biological Sciences, University of Queensland

The ancestral reproductive strategy of sponges (Porifera) is conserved in most demosponges which brood their larvae before dispersal, however some genera have secondarily evolved oviparity, releasing their eggs for dispersal with larvae developing externally. The taxonomic significance of oviparity has been challenged by molecular evidence, therefore understanding how oviparity evolved in different groups is important for resolving the phylogeny of Demospongiae. As the earliest metazoan branch, with the most homology to metazoans during development, the evolution of development in sponges is important in reconstructing the last common ancestor of Metazoa. Most haplosclerids are viviparous and have Parenchymellae larvae, while little is published on the reproductive biology of oviparous genera. To determine how the ancestral larval type is modified in oviparous haplosclerids, we describe the larvae of *Xestospongia bergquistia* using a suite of microscopy techniques, showing that larvae are smaller and less complex than the brooded larvae of *Amphimedon queenslandica*. Monociliate columnar epithelial cells comprise most of the *X. bergquistia* larval epithelium, those in the posterior third becoming larger over a gradient. The larvae lack the posterior tuft and bare poles typical of Parenchymella. Furthermore, no spicules or sclerocytes were identified in the solid inner cell mass. Our results suggest that marked differences from the typical brooded Parenchymella larva found in closely related haplosclerids have arisen as a result of evolving external development.

P37.

Back to the future: how the Holocene sea level highstand helps us predict the future of coral reefs

Stella Knief and Dr. Daniel Harris

School of Earth and Environmental Sciences, University of Queensland

Reef building coral is declining globally, raising the concern that coral reefs may be unable to produce sufficient carbonate material to respond to rising sea levels (RSL). This may lead to inundation and erosion of low-lying tropical coastlines. Carbonate loss is a key input for models that forecast coral reef change under warmer climates and RSL, yet it remains poorly understood. This research examines the loss of carbonate material from coral reefs in the mid- to late-Holocene where sea level was 1-1.5 m higher. Eight sediment cores were taken from the One Tree Reef (OTR) lagoon. Accretion and sedimentation rates were calculated to determine the sediment supply to the reef slope, crest, and flat. Changes in carbonate producer dominance were monitored by measuring the ratio of foraminifera and non-foraminifera carbonate producers present within each core. Sedimentation, accretion and foraminifera contribution were all found to be temporally and spatially variable: the central apron accretes the fastest (1.1_x_10-3_m_yr-1) while the reef edge is the slowest (1.65_x_10-4_m_yr-1). The reef edge had the lowest rate of sedimentation (7.24_x_10-5_kg_m-2_yr-1), whilst the central apron (8.52_x 10-4 kg_m-2_yr-1) lags behind the lagoon (1.83_x_10-3_kg_m-2_yr-1) in sedimentation rate. This results in an increased sediment supply to the central apron, promoting apron growth and lagoonal infill. Foraminifera were most abundant in cores taken closer to the higher energy regions of OTR and increased in abundance across OTR. RSL may therefore shift carbonate producer dominance in favour of foraminifera, subsequently, reef island stability may weaken as foraminifera have greater transport potential than coral rubble. The sedimentation rates obtained are ultimately compared to estimated sedimentation rates taken from current literature to verify Holocene sedimentation models

P38.

Can preimplantation genetic testing improve outcomes for patients with structural chromosomal abnormalities? A systematic review

Wilbert Wong and Professor Hayden Homer

UQ Centre for Clinical Research, Royal Brisbane & Women's Hospital Campus

Patients carrying structural chromosomal abnormalities may have difficulty reaching a live birth, as they often miscarry or present as infertile. Preimplantation genetic testing (PGT) has been proposed to help patients with these abnormalities by selecting viable embryos, seeking to decrease miscarriage rate and increasing live births. However, there is no clear consensus on whether PGT is beneficial, with many studies showing no difference in live birth rates. A search of MEDLINE, EMBASE, Web of Science and Cochrane was conducted on December 10, 2018, which yielded 44 results. Delivery rates and miscarriage rates were determined for each study, showing a decrease in miscarriage rate and an increase in delivery rate. This results from this study may be limited by the embryos lost during the biopsy process in PGT not being accounted for. Overall, PGT should be recommended to patients with a structural chromosomal abnormality, however clinical practice should also make patients aware of the number of embryos lost when undergoing PGT to confirm whether PGT is suitable for their circumstances

P39.

The Role of Sox9 in the Endothelium

Benedict Loweke, Ghazeleh Hashemi Mazlaghanian and Dr. Jatin Patel

Diamantina Institute, University of Queensland

Blood vessels in human vasculature serve to facilitate the distribution of vital nutrients necessary for survival and the disposal of waste. Tumour vascularisation allows tumours to connect to the existing vasculature and become nourished by it. Therefore, targeting of tumour vasculature and the mechanisms of tumour vascularisation has been an area of key interest in the prevention of tumour proliferation. Angiogenesis has traditionally been thought to be the primary modality of tumour vascularisation and establishment within the pre-existing vasculature network of the tumours host. In a novel model of tumour vascularisation, research within our lab has highlighted a population of vessel resident endovascular progenitor cells (EVP) within the endothelium that directly contribute to tumour vascularisation by the de novo formation of blood vessels within the tumour (neovascularisation). In this model EVPs infiltrate the tumour from the periphery towards the centre, this is followed by clonal expansion and differentiation into blood vessels and other tumour vasculature. Sox9 has been shown to play a key role in maintaining EVP stem cell characteristics in which transgenic Sox9 knockouts successfully depleted this population and reduced colony forming capacity. Endothelial knockout of Sox9 with our model (Sox9fl/fl/ Cdh5CreERt2 /Rosa-YFP) demonstrated a reduced number of EVP derived blood vessels and area fraction at the necrotic tumour centre. Knockout also reduced blood vessel size and area fraction within the lung vasculature. These analyses identify Sox9's key role in EVP driven tumour de novo neovascularisation as well as indicate the role of EVPs in the homeostatic lung vasculature.

P40.

Fetal brain parameters are altered in a rat model of maternal hypothyroidism

Elliott Neal, Nykola Kent and James Cuffe

School of Biomedical Sciences, University of Queensland

Thyroid hormone (TH) is essential for fetal brain development and is required throughout pregnancy to ensure normal cognitive function in later-life. Since fetal TH production does not occur until late gestation, during early development, the fetus depends on the maternal TH supply for growth. While approximately 7% of women experience hypothyroidism during pregnancy, how this impacts fetal brain development remains unclear. Female Sprague-Dawley rats were treated with 0.02% w/v methimazole prior to mating and throughout pregnancy to induce thyroid deficiency. Dams were culled on embryonic day 20. Fetuses were removed, weighed and brain tissue was snap frozen for subsequent analysis. Maternal hypothyroidism reduced fetal body and brain weights but did not impact the brain to body weight ratio. Dio2 mRNA expression increased in female but not male fetal brains, while Thra, Thrb, Dio3, Slco1c1 and Slc16a2 were unaffected. Finally, treatment reduced Complex I (NDUFB8) protein expression in fetal brain tissue but did not impact Complex II (SDHB), III (UQCRC2) or V (ATP5A). Our preliminary data demonstrates that maternal hypothyroidism induces fetal growth restriction and impacts fetal brain weight in rat. Given that T4 enters the brain via the choroid plexus for local conversion to T3 by DIO2, increased Dio2 mRNA may suggest the presence of a sex-specific compensatory mechanism to increase T3 availability. While reduced Complex 1 expression likely reflects thyroid status, further investigation is necessary to determine if this reduction persists in euthyroid aged offspring and if such reduction, transient or persistent, is associated with functional brain deficits.

P41.

Validating the cellular target of a repositioned calcium channel inhibitor for Parkinson's disease

Caryse Fong, A. Hicks and R. Gordon

Centre for Clinical Research, University of Queensland

Increasingly, research has aimed to identify novel therapeutic targets for Parkinson's disease (PD) that reduce disease progression. This study analysed the target of an anti-hypertensive drug to identify if the target was expressed in a cellular dopaminergic neuronal model, if target activation was increased during apoptotic neuronal death, and if inhibition of pathway activation conferred neuroprotective effects in vitro. It was found that the target activation occurred at low levels basally in dopaminergic neurons, and that target activation increased and had subcellular localisation in cellular models of Parkinsonian neuronal cell death. Preliminary data indicates that inhibition of this pathway with the repurposed drug could have a neuroprotective effect. This indicates that inhibition of this target activation pathway has potential as a therapeutic target to reduce PD progression, with repurposed drugs showing promise in pre-clinical models.

P42.

Development of survey to understand the KAPs surrounding the use of secondary disinfection in the control of Cryptosporidium

Samuel Brown and Associate Professor Simon Reid

School of Public Health, University of Queensland

Cryptosporidium is a parasite that infects the gastrointestinal tract of humans and causes diarrhoea. Cryptosporidium is primarily transmitted via the faecal-oral route through swimming pools which is facilitated by the presence of an environmentally hardy oocyst that is highly resistant to chlorine. However secondary disinfection, such as ozonation and UV irradiation, are effective in inactivating Cryptosporidium in pool water. Despite this, the majority of commercial swimming pools do not have secondary disinfection systems. This study involves the development and piloting of a survey tool to gather data from pool managers on the knowledge, attitudes and practices surrounding the use of secondary disinfection in the control of Cryptosporidium. The survey was developed using two existing questionnaires and finalised with feedback from an environmental health expert. Changes made after the initial review included the addition of knowledge questions involving Cryptosporidium and changes to the wording of individual questions. The questionnaire was piloted by email dissemination with assistance from staff at a commercial swimming pool operator. Pool managers considered Cryptosporidium infection to be a high risk and believed that secondary disinfection technologies were effective. However, pool managers have not employed their use citing the expense as the primary barrier to their implementation.

P43.

Similarities and Differences of Discretisations of the Logistic Differential Equation

Montana Wickens and Dr Sabrina Streipert

Centre for Applications in Natural Resource Mathematics, University of Queensland

We consider three discrete analogues of the continuous population growth model, the logistic differential equation, and compare their properties. The discretizations we investigate are the logistic difference equation, the Beverton-Holt model and the Ricker model. Under the assumption of constant inherent growth rate and constant carrying capacity, we derive sufficient conditions for positivity and boundedness for each of the recurrences. These results aid our analysis of limiting behaviour and, utilizing numerical simulations, we reveal chaotic behaviour for all three discretisations. The appearance of bifurcation presents a stark dissimilarity from the continuous case. We then initiate the analysis of a more recent property, the Cushing—Henson Conjecture, originally formulated for the Beverton—Holt model, in the context of the Ricker model. We extend the comparison to harvested growth models by implementing a multiplicative survival rate, corresponding to harvest at the end of the time-period. The optimal survival rate corresponding to the maximum sustainable yield is derived and compared to the optimal survival rate in the continuous case.

P44.

Design of an Extended Cavity Diode Laser for Analysing Rb85/Rb87 two-component Bose-Einstein Condensates

Liam Balaam and Dr. Mark Baker

School of Mathematics and Physics, University of Queensland

Bose-Einstein Condensates (BECs) are a coalescing of physical matter into a homogenous state. Occurring at nano-kelvin temperatures, their key properties; super-fluidity, homogeneity and ability to trap light, make them useful in precision sensing of inertial forces and magnetic fields. The primary cooling process uses lasers and the quantum properties of electron shells to only absorb photons of certain energies. Net emission/remission produces a net force, reducing their kinetic energy and cooling them; in 3D, this is termed an ‘optical molasses’. Existing experiments at UQ laser-cool and trap Rb87 isotopes, furthermore simultaneously trapping Rb85 allows study of their interactions. Consequently, an extended-cavity diode laser (ECDL), was constructed (electrical/housing components) to produce a precise 780nm trapping array. Essentially, ECDL’s use feedback loops to effect changes in cavity length (Piezoelectric) and laser temperature (Peltier), improving precision/accuracy. The net process involved applying feedback-control theory and learning to solder sensitive circuitry. Previous work indicates that two-dimensional trapping in optical lattices is possible and refinement of stability in three dimensions is sought.

P45.

Mutagenesis of HER2 may prevent trastuzumab-induced cardiac dysfunction

Sophie Watson, Kinjal Patel, Dr Sherry Wu, Dr Melissa Reichelt and Professor Wally Thomas

School of Biomedical Sciences, University of Queensland

The human epidermal growth factor receptor 2 (HER2), which promotes cellular growth and proliferation, is overexpressed in ~30% of breast cancers. To target these tumours, the immunotherapeutic antibody trastuzumab is often prescribed. Trastuzumab binds to HER2, preventing HER2-induced cell proliferation, to treat patients' tumours. However, trastuzumab also inhibits cardiomyocyte HER2 signalling, inducing cardiac dysfunction in around 24% of women.

To address this problem, we designed mutant HER2 receptors, which contain perturbed residues at HER2's trastuzumab-binding site (consisting of 3 closely-aligned loops). These mutants, which could potentially be virally expressed in the heart, would ideally render HER2 resistant to trastuzumab, while hopefully retaining signalling activity.

PCR mutagenesis was used to generate HER2 mutants, which were differentiated from wild-type (WT) HER2 by restriction digest fragment comparison. Results suggest we have generated complete loop 1 mutant (ML1) and loop 2 mutant (ML2) HER2 receptors, and a partial loop 3 mutant, all in separate receptors.Immunoblotting of transfected HEK293T cells suggests ML1 and ML2 HER2 receptors appear to express in HEK293T cells. However, based on immunoblotting of EGF-stimulated and trastuzumab-treated transfected HEK293T cells, it remains unclear whether ML1 and ML2 HER2 undergo normal phosphorylation upon EGF stimulation, and whether this normal signalling persists with trastuzumab treatment.

Overall, there are significant therapeutic implications of developing trastuzumab-resistant, functional HER2 receptors, which could rescue heart function during breast cancer treatment. Further quantification of mutant HER2 localisation, phosphorylation, and trastuzumab resistance will progress this preliminary investigation.

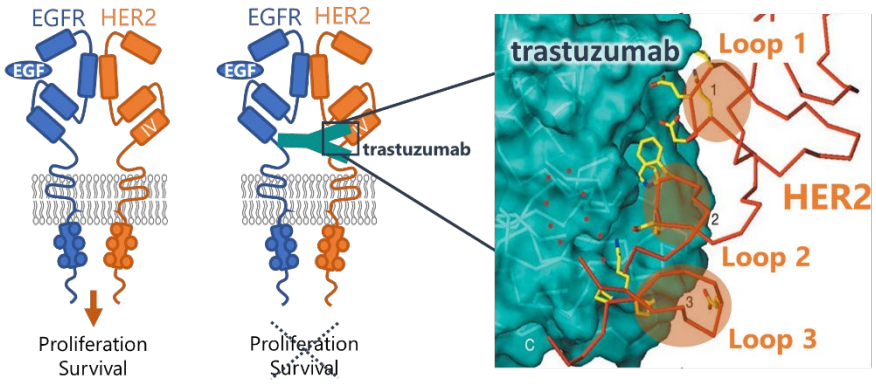

Figure 1. Trastuzumab binds to the HER2 receptor, preventing pro-growth signalling

P46.

Dynamic polarizability of macromolecules for single-molecule optical biosensing

Eloise Browne, Larnii Booth, Dr Nicolas Mauranyapin and Professor Warwick Bowen

School of Mathematics and Physics, University of Queensland

Sensitive optical biosensors that operate label-free commonly rely on the detection of light scattered by single molecules. This elastic scattering signal is proportional to molecular polarizability, which is a measure of the molecule's ability to form instantaneous dipoles under the influence of an external electric field. Most models of polarizability are based on bulk properties, which model the molecule as a dielectric. However, as dielectrics are a macroscopic concept and there is little homogeneity on the molecular level, it is unlikely that bulk models of molecular polarizability would produce accurate results. Moreover, discrepancies between measurement results and theoretical predictions have been repeatedly observed in the past. In response to this, we developed an atomistic model of polarizability, the modified dipole interaction model, and verified that it worked for various small molecules and bulk fluids, as well as for the protein bovine serum albumin. Our model further predicts that it should be feasible to monitor conformational changes of unlabelled single macromolecules such as chloroplast F¬1F0 ATPase synthase and the 26S proteasome using current single-molecule optical biosensing techniques.

P47.

Profiling Atypical Anxiety in Parkinson's Disease

Elana J Forbes, Gerard J Byrne, John O'Sullivan, Ji Hyun J Yang, Rodney Marsh and Nadeeka NW Dissanayaka

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Anxiety is a major non-motor complication of Parkinson's disease (PD). However, a high proportion of PD patients experience Anxiety not otherwise specified (NOS), being clinically significant anxiety that does not meet Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for a diagnosable anxiety disorder. As such, anxiety in PD is under-recognised and its diagnosis is under-developed. Thus, we aimed to identify the demographic, psychiatric, clinical and cognitive characteristics associated with Anxiety NOS in PD. A cross-sectional design was employed using a convenience sample of 184 nondemented PD patients recruited from neurology outpatient clinics. A semi-structured interview was used to categorise participants into three groups: PD patients with DSM-IV anxiety disorders, Anxiety NOS or no anxiety. Logistic regression models were constructed to identify characteristics associated with Anxiety NOS. Associations were found between Anxiety NOS and female gender, poorer quality of life, depression, global neuropsychiatric impairment, complications of PD therapy, the presence of dyskinesias, greater time spent with dyskinesias, greater time in the "off" state and persistent, episodic and social anxiety. Anxiety NOS demonstrated more severe therapy complications, greater global cognitive impairment and higher levodopa doses than DSM-IV anxiety. These findings present evidence that Anxiety NOS in PD is a distinct, fluctuations-based, PD-specific anxiety subtype. These identified characteristics of Anxiety NOS in PD could facilitate increased recognition and treatment of anxiety in PD.

P48.

Influence of loom position on visual habituation in larval Zebrafish

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The ease of genetic manipulation and optical transparency offered by Danio rerio (zebrafish) make it a prime model organism for real-time calcium imaging which allows for the investigation of its neural circuitry. Zebrafish have a broad repertoire of behaviours, including habituation; a non-associative form of learning characterised by the attenuation of behavioural and neural responses to a repeated stimulus. Habituation filters out irrelevant repetitive background stimuli which allows a state of responsiveness to a more salient sporadic stimulus. A visual loom stimulus (an expanding disc imitating an approaching predator), elicits distinct characteristic escapes response in zebrafish, but this response habituates with repeated loomed stimuli. Strangely, it has been shown that behavioural responses to repeated looms in free swimming fish is slower than that of the neural habituation to the same stimulus train in immobilised fish. We hypothesise that position of loom influences the rate of habituation, where looms presented to various parts of the visual field will cause a slower rate of neural habituation. Using Selective Plane Illumination Microscopy (SPIM), I captured brain-wide calcium activity to stimulus trains of differently positioned looms. The results should shed light on the relationship between loom position and habituation, with implications for the neural network structure that underlies this complex sensory filtering process.

P49.

Impact of SSTs on Coastal Meteorology Adjacent to the Great Barrier Reef

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The key driver of climate variability is the disparity in sea surface temperatures (SSTs) around the globe. This variation in SST directly impacts the boundary layer in the troposphere (up to 1000m above sea level) as the quantity of latent heat released during a phase change differs. Due to the recent rapid increase in greenhouse gas concentrations in our atmosphere and the associate warming of the atmosphere, much of this excess heat is being absorbed by oceans. Hence, SSTs and SST anomalies are increasing. The specific impact of this on coastal meteorology along the Great Barrier Reef is unknown. This report determined that warm SSTs had a more significant impact on certain meteorological parameters, than a rapid increase or decrease of SSTs. Warm SSTs were correlated with an increase in rainfall, dew point temperature, relative humidity, cloud cover and a decrease in mean sea level pressure. Hence, indicating that warm SSTs cause overlying air to warm, increase moisture content and become positively buoyant. These results demonstrate how warming of SSTs adjacent to coastlines will impact coastal meteorology and climate. This information can be used to begin analysis into causal relationships with for example, cloud type which was not considered in this report and can provide new insight into atmospheric behaviour such as coastal storm genesis.

P50.

Karrikinolide: A new compound to promote growth in the Solanaceae family

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School of Agriculture and Food Science, University of Queensland

Due to confidential IP associated with this research, the poster and abstract are not shown.

P51.

Integrating an inducible cell cycle reporter into safe harbour site of pluripotent stem cells

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Cell cycle is the process by which a cell duplicates it DNA and divides to form 2 daughter cells, with 4 stages: growth 1 (G1), DNA replication (S), Growth 2 (G2) and cell division (M). Its study is important for understanding development, wound healing and cancer. Fluorescent ubiquitination-based cell cycle indicator (FUCCI) uses a red fluorescent protein to mark G1 and a green one to mark S, G2 and M. There are many varieties of FUCCI, including the more compact FastFUCCI which speeds up the work flow. Usually, they are transfected into mammal cells using a lentiviral vector, a plasmid derived from lentiviruses (e.g. HIV), as they integrate themselves into the human genome. However, these randomly insert, leading to variable expression and potential disruption of surrounding genes. To overcome this, fastFUCCI can be targeted to a safe harbor site, a location in the genome with stable expression and little effect on surrounding genes. One such site is Adeno-Associated Virus Integration Site 1 (AAVS1), which can be targeted by putting the fastFUCCI gene in an AAVS1 vector. It is then targeted to AAVS1 using Transcription activator-like effector nuclease (TALENS). TALENS cuts the AAVS1 site at specific locations allowing for homologous recombination that incorporates fastFUCCI. As a proof on concept, FastFUCCI-AAVS1 plasmid was transfected into HEK293T cells and shown to work when the antibiotic doxycycline is added. This will be used in human induced pluripotent stem cells (hiPSCs) to generate a clonal line.

P52.

Isolation and Characterisation of Secondary Metabolites from *Cymbopogon procerus*

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Melioidosis, a disease caused by the bacterium *Burkholderia peusdomallei*, has a 50% mortality rate despite aggressive antibiotic treatment. Due to this lack of effective treatment, it is considered a candidate for bioweaponisation, making potential drug molecules highly sought after. *Cymbopogon procerus* is an Australian species of lemongrass used historically by multiple indigenous Australian groups as a treatment for colds, headaches and cuts. In addition to its use in traditional medicine, it has been observed to inhibit growth of *B. pseudomallei* in its rhizosphere. Therefore, compounds from a methanol extract of *C. procerus* were characterised to create a library of compounds that can be screened for anti-pseudomallei activity in the future. Elemicin was found in the ground plant extract, while 3,4,5-trimethoxyphenyl methanol and loliolide were extracted from the 30% methanol fraction of the extract. Elemicin has previously been found in large quantities in *C. procerus*, and it was found that by cutting rather than grinding the sample for extraction, the amount of elemicin extracted could be reduced. 3,4,5-Trimethoxyphenyl methanol has a similar chemical structure to elemicin and likely comes from the same biosynthetic pathway, and loliolide is a known plant compound with anti-bacterial properties.

P53.

Enriching and Sustaining Cancer Stem Cells with Polymer Nanoparticles

Yushu Gu, Dr Wenyi Gu and Professor Michael Monteiro

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Colorectal cancer (CRC) is one of the leading causes of mortality worldwide. The better understanding of the biology behind it is crucial for designing efficient therapeutic strategies for CRC. Mounting studies suggested a cancer stem cell (CSC) model in which there are small distinct subpopulation of CSCs within tumour cells which generates intra-tumour heterogeneity and has the ability of self-renewal, differentiation, metastasis and tumorigenicity when transplanted into an animal model as well as chemotherapy and radiotherapy resistance.

There is a need for improving tumour sphere culture techniques as it provides important insights to CSC research. Most tumour cells reside in a three-dimensional (3D) microenvironment where the cells communicate with proteins from the extracellular matrix (ECM) and neighbouring. Therefore, the traditional two-dimensional (2D) cell culture systems that are currently widely used in vitro anti-tumor drugs test fail to exhibit adequate cell-cell and cell-ECM interactions in which limits the ability of the cells to mimic the in vivo cellular responses. Recent advances in research have elucidated that 3-dimensional (3D) sphere culture system is more efficient for culturing CSCs from many cancer cell lines and solid tumours as they provide a stable environment maintaining cell-to-cell and cell-to-extracellular matrix contact, overexpress stemness related genes and pro-angiogenic growth factors. However, the traditional suspension culture method exhibits many limitations including low efficiency, high cost and complicated procedures. A novel 3D sphere formation system with the aid of nanoparticles which produces high efficiency is described in the current study to advance the traditional sphere culture system.

P54.

Expressional and functional study of various genes found predictive of type 1 diabetes onset in at-risk children

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Diamantina Institute, University of Queensland

Type 1 diabetes (T1D) is caused by the destruction of β cells within the pancreas. It is a complex disorder influenced strongly by both genetic and environmental factors. As such, only a small proportion of at-risk individuals will develop autoantibodies and subsequently T1D. There is currently no test available to predict which genetically susceptible children will develop T1D. Previous research has identified many genes believed to be predictive of T1D onset in at-risk children. This study aimed to analyse a subset of nine of these genes using real-time qPCR to confirm whether they were differentially expressed between at-risk patients who both did and did not progress to diabetes. Furthermore, this study analysed the function of one of these genes, SNX33, in more detail using a dextran uptake assay and flow cytometry. Although the gene expression assay wasn't conclusive and needs to be further confirmed by the addition of more samples, this study showed that fluid uptake was indeed decreased in T1D patients, suggesting SNX33 as a possible predictive gene.

P55.

Prognostic risk factors for pathologic scarring in patients with burns – a systematic review

Thuan Nguyen and Dr. Zephanie Tyack

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Acute burn wound care has always placed survival as the greatest priority. However, with dramatic improvements in survival following burn wounds over the past decades, with the evolution of various surgical techniques and treatment strategies; the spotlight has now been directed more towards reducing patient morbidity. Hypertrophic scarring (HTS) is a fibroproliferative disorder, posing both functional and cosmetic impairments to those affected. Despite the best available treatment, hypertrophic scarring continues to persist in patients suffering from burn injuries. With the exact mechanism underlying pathologic scarring still not yet fully revealed, investigation into prognostic or risk factors of pathologic scarring has been the focus of recent work. We examined predictive wound-related factors such as time to re-epithelialisation (time to wound healing), percentage total body surface area burned (%TBSA burned) and number of surgical procedures (NOS) and whether they impact the risk of developing pathological scars as well as quality of scar following wound closure. Whilst the data is suggestive of the three prognostic factors (TTH, %TBSA burned and NOS) influencing scar outcomes, so far there is no conclusive data regarding this. Risk of bias evaluation and heterogeneity tests are yet to be done to properly substantiate these findings.

P56.

Redshift effects in entangled quantum particles

Shaun McAnally and Dr Magdalena Zych

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One of the most significant frontiers of quantum theoretical and experimental investigation has been the analysis of the properties of entangled particles. Recent technological progress has enabled entangled particles to be separated by significant distances (even to Low Earth orbit), and as a result, theoretical physicists have developed a more fundamental understanding of quantum entanglement. The consolidation of general relativity with quantum theory is one of the most significant open questions in theoretical physics. Understanding the effects of general relativity on entangled particle states has been seen as a potential source of consolidation of these disparate theories. Through an iterative theoretical process, we devised a model which described the time evolution of an entangled quantum system in which both particles existed at differing positions within the same gravitational field. This new model was then applied to physical scenarios in which we were able to demonstrate that the time evolution of the entangled quantum state was directly influenced by this gravitational redshift. Such a quantification of the theoretical impact of gravity on the time evolution of an entangled quantum state provides a tangible link between these theories which could inform the design of future experiments conducted on such systems.

P57.

HER2 Mutagenesis To Prevent Trastuzumab Binding

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Breast cancer is the most common cancer affecting Australian women. Approximately 30% of breast cancers are characterised by overexpressed human epidermal growth factor receptor 2 (HER2). Trastuzumab, a monoclonal HER2-specific antibody, is a frontline immunotherapy for HER2-positive breast cancer patients. However, Trastuzumab also inhibits normal cardiomyocyte HER2 signalling, causing left ventricular dysfunction and congestive heart failure in approximately 24% of patients. This project endeavoured to create functional a Her2 protein with mutations in two binding sites (Loop 2 and Loop 3) of HER2 Domain IV with the aim of reducing binding affinity for Trastuzumab while retaining signalling activity (Fig. 1). We hypothesise that adeno-associated virus-induced expression of this plasmid in cardiomyocytes could abrogate cardiac damage during Trastuzumab therapy. Using a previously validated Loop 3 mutant HER2 backbone, PCR mutagenesis was used to generate Loop 2/3 HER2 mutants (ML2/3). Successful creation of ML2/3 was verified by diagnostic gel electrophoresis and Sanger sequencing. To assess HER2 mutant cell surface expression, HEK293T cells transfected with the mutated HER2 construct were immunostained for HER2 using anti-ErbB2 Affibody Molecule and assessed for Trastuzumab binding affinity by labelling Trastuzumab with an Alexa Fluor 647 secondary antibody. ML2/3 was expressed in HEK293T cells and displayed diminished binding affinity for Trastuzumab. Future studies are required to confirm that ML2/3 dimerises normally and can initiate intracellular signalling cascades. Thus, the HER2 ML2/3 mutant may be appropriate for AAV-mediated delivery to cardiomyocytes to confer protection against Trastuzumab-induced cardiac damage.

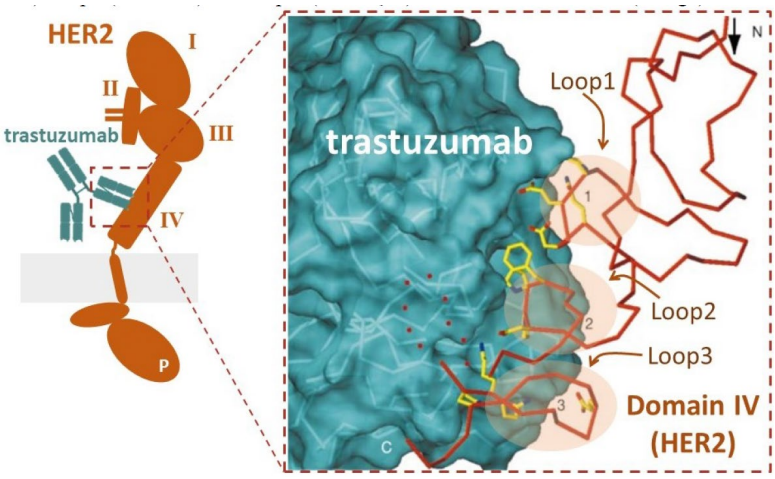

Figure 1. Trastuzumab binds at three sites in HER2 Domain IV

P58.

The Role of Nuclear Factor One X in the Development and Maturation of Ependymal Cells in the Central Nervous System

Ingrid Miller, Danyon Harkins and Professor Michael Piper

School of Biomedical Sciences, University of Queensland

Nuclear Factor One X (Nfix) belongs to the Nuclear Factor I family of transcription factors, which play key roles in stem cell development and regulation. Nfix has a critical role in central nervous system (CNS) development, with mouse knockouts displaying macrocephaly, hydrocephaly and associated intellectual disability. While Nfix has been shown to be required for normal ependymal development in mouse models, the underlying mechanisms behind the hydrocephaly observed in Nfix knockout mice are unknown. Previous work by the Piper Lab has suggested partial down-regulation of several proteins involved in adherens junctions, including β-Catenin, following Nfix knockdown in epithelial cell culture models. These observations led to the hypothesis that Nfix plays a key role in cell-cell adhesion, and that failures in cell adhesion may underlie the observed hydrocephaly. To investigate the role of Nfix in ependymal cell adhesion, immunofluorescent staining was conducted for markers associated with ependymal adhesion, polarity and maturity in Nfix wildtype and knockout mice at various time-points during ependymal development. Analyses of the walls of the lateral ventricles in the CNS, performed at postnatal days 10 and 15, revealed deficits in expression and distribution of: atypical protein kinase C (aPKC), a protein important in regulating cell polarity; β-catenin, a protein key for coordination of cell-cell adhesion, and; ZO-1, a protein critical for tight junction function. From this, it can be concluded that Nfix plays a key role in the regulation of cell polarity and adherens junction function in ependymal cells; the observed hydrocephaly phenotype in Nfix knockout mice may result from compromised epithelial structure in the lateral ventricles of the brain.

P59.

Lactic Acid Fermentation of Green Seaweed *Ulva fasciata*

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This research aims to investigate the fermentation of green seaweed *Ulva fasciata* using lactic acid bacteria (LAB). Six different strain of LAB: *Leuconostoc mesenteroides*, *Leuconostoc holzapfelii*, *Leuconostoc lactis*, *Weissella confusa*, *Weissella cibaria* and *Lactococcus lactis* were used as a starter culture in the fermentation. Filtered seaweed extract (FSE) was used as an initial trial of fermentation on all strain. After getting a positive result, fermentation was conducted in the fresh seaweed. Fresh seaweed was weighed and put in the jar and approximately 102 - 104 CFU/mL of each strain was added, and each sample of strain was treated with and without the addition of 0.5% glucose during fermentation. Control was used without the addition of any strain and treated with and without the addition of 0.5% glucose during fermentation. Overall, 14 samples were investigated during fermentation by measuring the pH and the number of cell growth every 0, 2, 4, 6, 8, 26, 48 and 72 hours and the changes of appearance and odour were examined.

The result showed that all bacteria strains able to grow in the seaweed and was indicated by the increasing number of the cell during the investigated time point. The addition of 0.5% glucose favours the fermentation by decreasing the pH up to around 4, while sample without glucose was similar or slightly increase from the initial pH. The changes of colour on all samples occurred starting after 24 hours of fermentation, and the colour turned into brownish with the increase time of fermentation.

Figure 1. *Ulva fasciata*

P60.

Understanding the immunomodulatory effects of faecal microbiota transplant (FMT) intervention during stem cell transplantation

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Bone Marrow Transplantation remains the most preferred treatment methods for Leukemia. Post chemotherapy and radiation therapy, patients undergo Allogenic-BMT, for restoring the red blood cell population and destroying leukemia cells. One condition that limits this approach is The Graft versus Host Disease (GVHD), in which donor T cells, triggered by factors secreted from the gut, get activated and begin to expand, thereby causing the disease. Certain microbial metabolites have been found to have crucial roles in maintaining the barrier integrity and during disease condition, the barrier integrity weakens, causing factors secreted by the gut microbiota to enter the bloodstream. But, the actual bidirectional relationship between barrier integrity and intestinal microbiota, and their combined roles in GVHD remains unclear. This study aims to investigate this relationship, by way of Fecal Microbiota Transplant (FMT) which aims to restore the host microbiome, post transplantation. The effects of this restoration, on attenuation of GVHD will be studied. Post transplantation (with Major MHC mismatch) an auto FMT model was created by cohousing equal number of faecal donor and recipient mice and the restoration of gut microbiota was analyzed by 16srRNA sequencing. To further enhance the efficiency of FMT, the number of donors were increased to twice the number of recipients and the combined results showed that the efficiency of FMT significantly increased with more donors. Also, T cell dosage, was doubled in to achieve survival curve separation faster in 1:1 donor : recipient experiments. Further studies to be performed in near future would include studying the relationship barrier integrity and gut microbiome and their roles in the pathogenesis of GVHD.

T1.

Developing a computational tool to model chemical reaction kinetics based on quantum mechanical data

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Computational approaches to simulating reaction kinetics allow for the visualisation of a reaction's progress over time. This offers new perspectives for understanding, comparing and verifying proposed reaction mechanisms with regards to timescale. Recently, theoretical studies have paired free energy profiles with kinetic analyses to elucidate the extent to which different reaction pathways lead to common products. However, available programs for kinetic modelling are impractical for theoreticians as they rely on rate constants as opposed to activation free energies barriers (ΔG‡), the latter of which can be determined from quantum mechanical calculations. To overcome the challenge of manually converting free energies to rate constants, a new kinetics program – suitable for quantum chemists – has been written. This software (called KinetiChem) uses a deterministic approach in which differential equations are generated from a proposed mechanism and ΔG‡ inputs, then are numerically integrated to produce graphical solutions. For the tested reaction mechanisms, KinetiChem performed comparably in terms of output and speed with the commercial kinetics program ReactLab KINSIM. In this research, the new software was also used for a case-study into the silylation of 1-methylindole. Current work on this case-study shows promise for the use of kinetic simulations to understand the complex interplay of parallel mechanisms. Future improvements to the software design and usability could help turn this program into an efficient computational tool that allows chemists to use both quantum chemistry and chemical kinetics to determine how accurately proposed mechanistic pathways reflect experiment.

T2.

Profiling dog bite emergency department presentations in the Metro South Public Health region of Brisbane: epidemiology, treatment efficacy and geographical analysis of populations at risk

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Logan Hospital, Metro South Hospital Service
Children's Health Research Centre, University of Queensland

Dog bits are recognised as a growing public health problem, with an estimated 100,000 persons attacked by dogs in Australia each year, including an average of 2,061 hospitalizations per year. The burden of disease associated with dog bites includes health consequences for individuals, healthcare costs, as well as economic and social impacts in the wider society. It is therefore necessary to assess the epidemiology of dog bite injury as well as providing evidence for the development of improved public health policy targeting at risk populations and the management of the victims of dog bites.
The overarching aim of this study is to understand the epidemiology of dog bite injuries in the Metro South Public Health region from mid-2013 to mid-2017, including determining factors for morbidity/mortality, and factors which determine the geographical distribution of dog bites. To date, this will be the first Australian based study to utilise spatial analysis techniques to investigate dog bites. Risk factor analysis will help clinicians identify dog bite patients at risk for ongoing morbidity/mortality, and thus facilitate development of ED management protocols for patients to minimise dog bite health burden. Spatial analysis of patient presentations will enable predictive mapping of dog bites and thus enable public health groups to provide a more rational implementation of dog bite control interventions locally to councils. Specifically, it will optimise the distribution of dog bite control interventions to target high risk geographical areas.

T3.

Modelling spin crossover chains

Lachlan Parker and Professor Ross McKenzie

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Phase transitions are a deep, recurring property of the physical world. Understanding them helps us to explain phenomena as exotic as superconductivity and as common as boiling water. We investigated a type of phase transition known as a spin crossover – where the molecules in a material will spontaneously change their magnetic moment (from non-magnetic to magnetic or vice versa) under a change in temperature or pressure. There are many different models of spin crossover, however most of these models are either too complex or don't adequately explain all the relevant physics. The model we used is what's called a pseudo-Ising model – where we consider the energy and entropy difference per molecule between the non-magnetic and magnetic states, as well as interactions between nearby molecules. Our aim is to show that complex models with many free parameters are not required for an adequate description of many spin-crossover compounds – much of the essential physics can be described by this relatively simple model.

T4.

Utilising Whatman FTA card technology to identify cell free schistosome DNA in a mouse model

Madeleine J. Rogers, Catherine A. Gordon and Donald P. McManus

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Molecular Parasitology Laboratory, QIMR Berghofer Medical Research Institute

Schistosomiasis is a neglected tropical disease (NTD), with 700 million people at risk in 78 endemic countries. Schistosomiasis is caused by parasites of the helminth genus, Schistosoma, the most significant of which is Schistosoma japonicum, which exhibits a zoonosis with 45 different mammalian species. This study aims to (1) validate the use of Whatman FTA cards as a storage medium for schistosome cfDNA from clinical samples, including urine, faeces, blood, sera, and saliva; and (2) to determine in combination with Whatman FTA cards the most accurate and cost-effective diagnostic methods from direct PCR, qPCR, and ddPCR. Current protocols for storage of clinical samples lack accessibility in remote, schistosomiasis endemic areas, and can be expensive to transport back to a central laboratory. Whatman FTA cards can store clinical samples at room temperature for long periods while still maintaining DNA stability. These samples can be used for diagnosis using molecular techniques. In addition, recent advances in research have shown that both ddPCR and qPCR can successfully detect schistosome cfDNA in larger volumes. The use of Whatman FTA cards for storage of specific clinical samples containing cfDNA presents an exciting opportunity for the development of a new storage and diagnostic methods.

T5.

Quantum Thermalization and Entanglement Entropy in the Ising Model

Liam Bond, Dr. Arghavan Safavi-Naini and Professor Matthew Davis

School of Mathematics and Physics, University of Queensland

If a hot cup of coffee is left on a table, the coffee will cool until it reaches thermal equilibrium with its surroundings. In this process, as the coffee and the surrounding air interact, the combined system evolves from an ordered state (low entropy), to a disordered state (high entropy). This one-directional evolution maximizes the entropy, at which point the system has "thermalized" and undergoes no further changes.

This coffee cup scenario is described by statistical mechanics, a classical theory, which prescribes that the maximization of entropy is the driving factor of thermalization. Statistical mechanics accurately describes macroscopic objects, but not smaller ones (such as electrons) which instead require quantum mechanics. In quantum mechanics, pure, isolated systems are time-reversible, which prohibits the emergence of entropy. However, recent work has shown that some quantum systems thermalize as predicted by statistical mechanics. The question is therefore how a pure, isolated system with no entropy can be predicted by statistical mechanics, a theory based on the emergence of entropy.

In this work we investigate the thermalization of quantum systems through the time-evolution of a quantum model, the Ising Model. Here, electrons are chained together through nearest-neighbour interactions, and interact with a transverse magnetic field. We develop a computer model to simulate a finite chain and consider the role of entanglement in thermalization. We confirm previous work to show that after a sudden change in magnetic field strength, although the chain does not thermalize, it can equilibrate to a near-thermal value.

T6.

A Window to the Past or: How I Learned to Stop Worrying and Love Rooted Phylogenies

Thomas Hassall and Professor Gavin Huttley

Research School of Biology, Australian National University

There currently exists various mathematical approaches for modelling the mutations within DNA in order to estimate the relatedness of different species. By assessing the differences between DNA sequences, we can simulate the mutation process required to transform one species' DNA into another's. A recent mathematical result has allowed for the untangling of the evolutionary 'arrow of time' without the need for previously required external reference sequences. This raises the possibility of a radically new paradigm for rooted phylogenetic reconstruction, with a novel 'codon' model potentially providing the telescopic power to peer further into life's past than ever before…

T7.

Development of a method to test vascular competency of *Fusarium oxysporum* f. sp. *cubense* subtropical race 4 (Foc SR4) in Cavendish banana (*Musa acuminata*)

Montana Hickey, Dr Jay Anderson, and Professor Elizabeth Aitken

School of Agriculture and Food Science, University of Queensland

Fusarium oxysporum f. sp. *cubense* (*Foc*) is a soilborne fungus responsible for causing Fusarium Wilt (also known as Panama disease) in bananas (*Musa* spp.). The most aggressive strain of this fungus, race 4, currently threatens 80% of the world's banana production. Spores of this fungus are able to lie dormant in soil for a number of years and can also be spread through a variety of anthropogenic means including planting material, mechanical transport (e.g. tractors), and footwear. Once the fungus comes into contact with the roots of a plant, it enters via those roots and grows upwards into the xylem, colonising and degrading the vascular system. Interestingly, a 2011 study found that Australian isolates of *Fusarium oxysporum* f. sp. *vasinfectum* (*Fov*) in cotton were described as vascular incompetent when injected directly into the xylem, as opposed to a typical root dip inoculation. The aim of this project was to develop a method, which can be used to determine whether, similar to the *Fov* isolates, the Australian *Foc* isolate is vascular incompetent when the stem-puncture method is undertaken to infect the xylem. In order to track the movement of the injected isolate, food dye was used with the *Foc* spore suspension. Germination assays of the fungus were done to investigate whether the dye interferes with the infection potential of the pathogen. Future studies could use this information to further understand the infection process of *Foc* and inform effective management practices in the field.

T8.

Investigating quantum gravity in neutrons

Germain Tobar, Dr Magdalena Zych and Dr Fabio Costa

School of Mathematics and Physics, University of Queensland

The two cornerstones of modern physics are quantum mechanics and general relativity. Quantum mechanics describes nature at the smallest scales of atoms and subatomic particles, whereas general relativity describes nature at the largest scales where gravitational effects dominate. However, the reconciliation of these two theories remains one of the biggest unsolved problems in modern physics. The difficult in tackling this problem is that the exploration of the joint regime of quantum mechanics and relativity is a significant experimental challenge. However, the relativistic effect of mass-energy equivalence can be used to probe the effects of general relativity in quantum systems. Relativistic physics predicts that a particle with a higher internal energy has more weight than a particle with a lower internal energy. The additional weight due to mass-energy equivalence will change the measured energies of the quantum particle. As a result, relativity predicts that a neutron in a magnetic field has different weight than a neutron that is not in a magnetic field. The neutron's different weight changes the energy of the neutron, which can be experimentally measured. This project aimed to theoretically calculate how much a neutron's energy would change due to the effects of mass-energy equivalence. An experimental measurement of this relativistic effect would provide the very first experimental test of the joint regime of general relativity and quantum mechanics and provide insight on how to unify the two theories.

T9.

Mitigating climate change through restoration of coastal wetlands in South-East Queensland

Tallis Baker, Sang Phan, and Catherine E. Lovelock

School of Biological Sciences, University of Queensland

Coastal wetlands, including mangroves and saltmarshes, grow in anoxic, saline soils of the intertidal zones. They sequester organic carbon at four to ten times the rate per hectare than that achieved by terrestrial forests. This makes them important sinks for carbon dioxide (CO2), which may help to mitigate the effects of climate change. Restoration of previously damaged, degraded, and converted coastal wetlands provides opportunities for increased carbon sequestration, as well as providing a range of other ecosystem services including biodiversity and improvement of water quality. We investigated the rate of carbon sequestration 15 years after tidal water was introduced to the site, using soil cores from mangroves, melaleuca forests, and open water ponds within the restored site as well as from adjacent sugarcane fields. We identified a marine clay layer underlying the site which provided a benchmark, allowing comparison of soil (and organic carbon) accumulated through restoration. Restored melaleuca forests sequestered 871.18 ± 6.36 g C m-2 year-1 in their soils. Mangroves accumulated a larger sediment volume over the 15 years (22 cm compared to 15.3 cm for Melaleuca), although with lower carbon density than Melaleuca, sequestering 863.17 ± 4.1 g C m-2 year -1. These rates are higher than mean global values reported for these ecosystems. By estimating rates of carbon sequestration in South-East Queensland coastal wetlands, we provide knowledge that can be used to develop carbon financing of restoration projects which can contribute to meeting Australia’s Paris Agreement obligations.

T10.

The Chicken or The Egg: Unpacking the Complex Interplay between Sleep Dysfunction and Neurodegenerative Disease

Jeremy Hunt and Dr Oliver Rawashdeh

School of Biomedical Sciences, University of Queensland

Sleep dysfunction has long been tightly associated with neurodegenerative disorders, indeed, in James Parkinson's seminal categorisation of his eponymous disease he highlighted that patients were often 'constantly sleepy' and 'exhausted'. Today, circadian disruption is commonly described as the most prevalent non-motor symptom of neurodegenerative disease, with up to 80% patients with Parkinson's disease or Alzheimer's disease experiencing some kind of sleep-wake arrythmia or deterioration. Despite this long-understood correlation, it is only recently that evidence has emerged to support the idea that these issues may not be just a result of neurodegeneration, but that sleep and circadian dysfunction may actually act as a trigger for neurodegenerative disease, and exacerbate the progression of disease. In this presentation, I will briefly discuss the pertinent state-of-the-art research in support of this theory, discuss proposed mechanistic links between circadian rhythms and neurodegeneration, before briefly considering the implications of these findings on both research into neurodegenerative disease and on clinical treatment of disease. As the body of research in support of this negative regulatory feedback interplay between sleep dysfunction and neurodegeneration continues to grow, and while cures for neurodegenerative disease remain out of reach, it is likely that sleep-based interventions will emerge as a key aspect of neurodegenerative disease management.

T11.

The Influence of Magnetic Field on Argon Emission Spectra

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The emission spectrum of a monatomic gas can be used to determine its temperature and electronic configuration. According to quantum mechanics, electrons exist in orbitals with discrete energy levels. The wavelengths of the emission lines depend on the distribution of energy levels, while the intensities of the emission lines depend on the temperature of the gas. Under the influence of a strong magnetic field, an energy level may split into multiple new levels with differing energies, resulting in broadened emission lines; this is known as the Zeeman effect. Previous work has examined the influence of an applied magnetic field upon certain gases in stationary conditions; however, relatively few studies have tested this with high temperature flow (HTF). This project aimed to study the effect of an externally applied magnetic field upon argon gas under both stationary and HTF conditions. A theoretical model was developed to predict the emission spectrum of argon at different temperatures. Experiments were performed to measure the emission spectrum of argon, with and without exposure to a permanent magnet. The results were compared against the theoretical model. No Zeeman effect was detected; however, the intensities of several emission peaks were observed to change with magnetic field strength. These results could be used to develop an enhanced model of argon emission spectra; improving our understanding of radiative processes in HTF.

T12.

Curcumin-based photosensitization as green treatment for the inactivation of Aspergillus flavus spores in peanuts

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The CUR-PS treatment involved exposure of peanuts inoculated with A. flavus spores to light emitted at a wavelength of 420nm for an illumination period of 15 minutes testing three different curcumin (CUR) concentrations of 50μM, 75μM and 100μM. It was established that the reduction of A. flavus spores was most effective at 50μM CUR concentration achieving a 1.7 log reduction in peanuts ($p>0.05$). In addition, the CUR-PS treatment extended the shelf-life of the photosensitized raw peanuts by 7 days compared to the untreated peanut samples with the treatment being most effective at 75μM of CUR. In determining the effect of the CUR-PS treatment on the reduction of AFTB1 levels, it was established that after 20 days storage, the non-illuminated peanuts had an average AFTB1 levels of 800mg/kg, while the light-only treated peanut samples had AFTB1 levels of 296mg/kg, and at 75μM CUR both the illuminated and non-illuminated peanut samples had the lowest average levels of AFTB1 of 38.3mg/kg and 41.1mg/kg respectively while at 50μM and 100μM respectively, the illuminated peanut samples had average AFTB1 levels of 59.2mg/kg and 58.1mg/kg respectively which was less than the non-illuminated peanuts that had AFTB1 levels of 108.8mg/kg and 105.3mg/kg respectively ($p>0.05$). The study showed that the CUR-PS is an effective treatment that can be used to control spore contamination in peanuts.

T13.

Extraction of viruses from high turbidity water samples

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The oceans cover 71% of the Earth's surface, yet we know more of the universe than how our ocean ecosystems function and the organisms that live in it.

Viruses are the most abundant organisms in our oceans, with about 200,000 different populations and approximately 10 million found per millilitre of surface seawater. Their impact on the chemistry and life on the ocean is yet to be fully revealed.

This study, conducted on water samples from the Brisbane River, Australia, aimed to understand the role of viruses in the microbial community and to identify novel viruses infecting Marine Group II archaea.

For that, a cost-efficient viral extraction method was developed and optimised for high turbidity water samples. Between 20 and 30 litres of water were collected and left to sediment for four hours, after which the water and the settled sediments were studied separately to obtain the overall viral concentration. The water fraction was processed through a series of filters, followed by viral precipitation using iron chloride. The sediments were sonicated and the viruses were separated by caesium chloride density gradient centrifugation. The flow virometry assay was implemented to monitor the viral concentration in each step of the water and sediment analyses. Flow virometry results showed that the viruses had been isolated from the initial samples so that it was possible to extract and sequence their DNA.

A metaviromics workflow using virSorter and virFinder was adopted to identify the viral population present in the samples and to create a community profile.

T14.

Community Use of a Landscape Approach to Wild Dog Control

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Wild dogs are considered a major issue for Australian agricultural communities, causing livestock and economic losses. The literature states that the most effective way to reduce wild dog numbers is for communities of landholders to use a coordinated landscape or nil tenure approach to combat the issue. There are, however, only limited instances where this approach is being used successfully, so we must ask, why aren't more communities using this tactic?

I chose to study an agricultural area which has a wild dog presence that is an identified issue for the local community. My research focuses on this community's response to wild dog control and investigates whether or not they use a landscape approach to tackle the issue, and to see what is happening in practice.

My results found that the landholders of the study area, for the most part, don't work together, yet they believe that a landscape approach is needed. Everyone interviewed identified the current wild dog presence as a problem, but those that aren't directly affected by them aren't willing to engage in a landscape approach, unless an organisationally approached them and encouraged them to work together. The individuals that were organisationally involved are willing to help but want the landholders to approach them first.

This project has identified a fundamental concern in pest control – the breakdown of communication between stakeholders. This major issue is only in one small community but is indicative of a larger social issue that has ramifications for community based invasive pest management.

T15.

Effects of compost quality and application rate on soil biological properties and C sequestration

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Amending soil with compost is a common agricultural practice to improve soil quality and crop yield. But less is known about the effects of different composts on carbon sequestration and soil biological properties. To explore the relationship between different compost types, application rates and soil types, we evaluated in laboratory scale experiments the functional responses of soil microbial communities in sandy and clay soil. We applied 2 and 10% (w/w) application rate of chicken manure compost (CMC) and vegetation residue compost (VRC). Decomposition rates were estimated by quantifying CO2 production rates, which increased after compost and moisture addition in all treatments, followed by a gradual decrease over time. Compare to no compost controls, addition of compost led to higher soil respiration rates across all treatments. CO2 emission rates ranked in the order 10% CMC > 2% CMC > 10% VRC > 2% VRC. The highest enzyme and microbial biomass were observed in the 10% CMC treatments of both soils. We observed a significant correlation between CO2 production rate, enzyme activity and soil N and C levels. Surprisingly, the levels of soluble inorganic N were higher in VRC than CMC treatments. In understanding how to optimise compost application favouring C sequestration, CMC confirmed its efficacy in increasing microbial biomass and thus SOC in our short-term experiment. However, further analysis, including organic carbon and phospholipid fatty acid (PLFA) analysis to characterise fungal and bacterial communities could offer further insight into the changes in microbial community with compost application.

T16.

Testing the quality of barley (*Hordeum vulgare*) through Near-Infrared Spectroscopy

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The use of barley for human consumption is mainly focused on the brewing industry. The range of protein content in barley typically varies from 9 to 15%. However, the barley destined to malt usually contains 8 to 13% of the protein on a dry basis. The starch is also an important component in the barley since it is Up to 60% of Starch.

The malting is composed of the following stages steeping, germination and kilning. During the germination, the barley suffers several internal changes as the degradation of the cell wall and the start of enzymes activity. Meanwhile, during the kilning, the barley grain is under heat, and the desire flavours start to form, the Maillard reaction takes place. Then is followed by the mashing where all malt is mix with water to obtain the hot water extract, which later will be fermented to get as a finished product the beer.

In order to assess the quality of the grain, non-destructive analysis has been developed. One of them is the use of infra-red, so the wavelengths in the MIR and NIR will help us to determine parameters such as protein, starch, moisture, mycotoxins, etc

Through this experiment, the protein content was predicted using the Single kernel near infra-red scan (SK-NIR) where a calibration curve was build using chemometrics. Figure 1 shows the spectra obtained from the scan of SK-NIR. Later the barley kernels were sorted according to the predicted protein content to assess the impact on the quality of the malt.

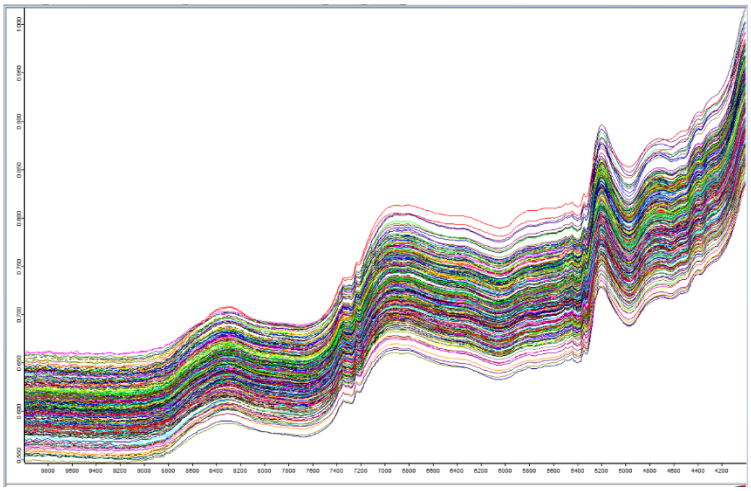

Figure 1. NIR Spectra

T17.

Textural Characteristics of Hydrocolloid Enriched Soy Yoghurt

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A systematic investigation on the effects of some functional hydrocolloids in soy yogurt formulations, namely pectin (0.5%, 1% and 2%), curdlan (0.05%, 0.1% and 0.2%) and β-glucan (2%, 3% and 4%) on the physical, tribological and rheological properties was studied.

Among the three hydrocolloids studied, curdlan appeared to be the most optimal one compared with LM pectin and β-glucan because it significantly reduced syneresis, increased texture, viscosity, gel strength as well as lubrication of soy yoghurt even in small concentration. As a result, the sensory evaluation for curdlan-enriched soy yogurts could be significantly improved. In comparison, β-glucan increased the firmness and viscosity of soy yoghurt, but also had high level of syneresis compared with pectin and curdlan. Additionally, pectin improved the lubrication performance but had too much changes on the texture of soy yogurt which could lead to undesirable firm texture. Consequently, curdlan and lower concentrations of LM pectin or a combination of both could be further developed and incorporated into soy yogurt. Besides, a four-zone tribological model for soy yoghurt was proposed by tribological analysis of the soy yogurt samples studied, in which each zone corresponded to a different fluid mechanism entrained between two contact surfaces. Thus, the tribological behavior of the soy yoghurt fluid could be represented by each transition point location and each friction zone slope.

T18.

The stability and the efficacy of novel Dyn1-7 analogues at KOP receptors

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Dynorphin (Dyn) A(1-17) is an endogenous neuropeptide that exhibits the highest affinity for kappa opioid receptors (KOPr) and plays multiple roles in analgesia and inflammation. Studies have shown that Dyn1-17 is rapidly converted to smaller peptide fragments by a series of enzymes after being released, and one of these fragment peptides, Dyn1-7, is also potent □-receptor agonists, but too short-lived to act as a drug. To improve the stabilities of these peptides, various Dyn1-7 analogues were specifically designed and constructed at the UQ School of Pharmacy. The hypothesis is that these analogues have similar efficacy at KOP receptors and are much more stable than Dyn1-7. And the same analogues may activate pERK at KOPr. In the experiments, these Dyn1-7 analogues were tested in HEK293 cells that were transgenic to overexpress KOP receptors. Novel peptides were tested in a blinded fashion, and activities compared to reference peptides Dyn1-7, Dyn1-17, and reference small molecule agonist (U50488H).

The stabilities of the analogues in rat plasma and trypsin solution were primarily tested to build the stability model in oral administration and intravenous administration. After that, the same peptides were tested in a phospho-ERK activity to identify their ability to induce the production of phosphor-ERK when acting at kappa receptors.

T19.

Traits and trade-offs: Australian rainforest plants display mixed adherence to seasonal drought response predictions

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Plant communities and species are shaped by environmental conditions. Strong environmental factors play a particularly critical role in determining species' adaptations to their environment. In Australia, seasonal droughts place unique pressure on plant communities. Previous work has reported drought response trait trade-offs that enable plant survival under challenging conditions. Using 26 Australian rainforest species, the present study aimed to test these trade-offs in an Australian context. Species were categorised per their driest tolerated habitat, and trait measurements taken for leaf dry matter content (LDMC), leaf area, specific leaf area (SLA), and turgor loss point (TLP). Leaf area and LDMC were only weakly correlated for plants found in mesic habitats. For those found in drier vine thickets, leaf area was negatively correlated with LDMC. This may reflect a shift towards the "avoider" strategies of the stress response spectrum, and a reduced investment in low-lifespan leaves. TLP was supported as a unifying trait, with significant relationships to both LDMC and SLA. This adds to a growing body of work describing TLP as a powerful single-trait indicator of drought tolerance. Overall, our results highlight the variability in drought response trait combinations. As climate change intensifies global and local seasonality, knowledge of these trait trade-offs will be important for predicting species' vulnerability to extinction and range retraction, and targeting conservation to suit.

T20.

Determining the origin of O-type stars

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The universe contains many astronomical objects, such as, young, hot and dense O-type stars. Accompanying the study of the formation of these stars, there has been significant debate as to whether these stars could form in isolation, or exclusively within stellar clusters. Previous research on these stars and their formation has shown that up to 90% formed in stellar clusters, with no clear evidence on the formation of the other 10%. This project aimed to assess a sample of 18,000 stars within the Milky Way, looking at their current positions relative to the centre of the galaxy. The sample was truncated to remove all stars outside of a certain radius, 1,000 parsecs due to uncertainty, and those within star clusters. Using a series of coordinate and velocities transformations, from an earth-based system to a galactic system, a collection of graphs was produced illustrating the positions of the star clusters and O-type stars in Cartesian coordinates. The isolated stars were further analysed, and a dataset of their velocities and proper motions was compiled. The isolation of these stars could be explained by an ejection from a binary star system or super novae explosion, implying a high velocity. However, for isolated stars with a low velocity, these predictions cannot be made, thus opening the door to discussion of how and where they formed.

T21.

Spatial distribution of latent activity in the neural circuits of developing zebrafish

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One of the fundamental problems of neuroscience is to understand how sensory information is encoded in the brain. Neural circuits often exhibit spontaneous activity that appears to occur independent of stimuli. In the developing zebrafish optic tectum it has been shown that this spontaneous activity is low dimensional; however the spatial distribution of the spontaneous activity across the optic tectum is unknown. In this work we applied a new statistical model to jointly examine the evoked and spontaneous activity of a set of neurons. We found that cells towards the posterior of the tectum were more stimulus driven whereas the cells at the anterior were more likely to be driven by spontaneous activity. This result suggests in young (4 days post fertilisation) zebrafish the rear visual field is more stimulus sensitive than the frontal visual field. This research provides new insight into the way neural circuits form and encode stimuli, and thus potentially into problems such as developing treatments for neurogenerative disorders and developing brain-computer interfaces.

T22.

Student perceptions of group work in an undergraduate physiology course

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Students working in groups learn valuable transferable skills including collaboration, teamwork, and critical thinking. Previous studies have investigated how students in academically homogeneous or heterogeneous groups perceive group work; however, results are conflicting and lack qualitative detail. We examined perceptions of 153 undergraduate physiology students who completed a group work assessment task. Students were categorised as belonging to homogeneous or heterogeneous groups based on their prior academic performance. Performance on the group work assessment task did not significantly differ between students in homogeneous and heterogeneous groups. Most students reported positive changes to their perceptions of group work after completing the task, with no significant differences in the reasons for this change between group types. Most students also reported beneficial aspects of group work, with similar aspects reported by students in both group types. Significantly more students in homogeneous groups reported non-beneficial aspects of group work than students in heterogeneous groups. However, significantly more students in heterogeneous groups reported the non-beneficial aspect of different opinions. Therefore, students in both group types experienced similar benefits of group work and had similar academic achievement. Although more students in heterogeneous groups reported different opinions as a negative experience, this is an essential skill. These results suggest that it is not necessary to allocate students into homogeneous or heterogeneous groups.

T23.

Membrane-active antimicrobial peptides and their atomic-level interactions with a lipid bilayer

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Membrane-Active Antimicrobial Peptides (MA-AMPs) are an evolutionarily ancient form of microbial defence in the innate immune system. In the wake of resistance to antibiotics MA-AMPs have been investigated for development as new anti-microbial treatments. There are many proposed mechanisms of MA-AMP action, of these the most commonly cited are pore formation, causing gradual leakage of cytoplasm causing cell death, and a carpet-like micellization resulting in complete cell lysis. These mechanisms are generally thought to be dependent on helicity and amphiphilicity. Here we propose that in addition to these properties, the presence of curvature in the helical MA-AMPs and its connection to membrane curvature is vital for membrane disruption. Currently, the specific details of how these factors contribute to mechanisms of membrane disruption are not well defined, as experimental methods lack atomic-level resolution of these systems. Using molecular dynamics simulations we investigated the interactions of two MA-AMPs, Dermadistinctin K (DDK) and Crotalicidin (Ctn), with lipid bilayers. We compare these peptides given their differences in structure and proposed mechanisms of action. For example, DDK has a well-defined helical structure proposed to act by a carpet-like mechanism, whereas Ctn has two distinct structural parts, a helical N-terminus and unstructured C-terminus, and is thought to be pore-forming. We observe these peptides causing significant disruption to the membrane and investigate what role secondary structure, amphiphilicity, and curvature have on this behaviour and how this influences mechanism of action, and how current proposed models are not representative of the complex interactions observed at the atomic level.

T24.

The optimisation of current fibre-optic systems in the classical and quantum regimes

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Fibre-optics is a common method of sending information encoded on optical signals which exploits the total internal reflection of electromagnetic waves transmitted through the fibre. This is often used in telecommunications to send information over long distances. Two primary amplifier types, phase sensitive and phase insensitive, can be used in optical fibre systems to boost the signal and allow transmission over long distances. The latter imposes additional noise on the signal, however, two quadratures can be encoded with information. Conversely, phase sensitive amplifiers impose no additional noise during amplification, but are restricted to transmission through a single quadrature. Although these systems are well understood, the type and configuration of amplifiers which maximises the signal strength relative to the noise is to be determined. Simulations indicate the greatest channel capacity is dependent on the noise associated with the initial signal. Phase sensitive amplifiers tend to dominate if the initial noise is closer to the quantum noise floor, regardless of the input power of the signal. If the initial noise is large, the choice of amplifier is dependent on the fibre length. A further dependence of the input power of the signal on the amplifier type was also shown for these systems. The results demonstrate the optimal amplification system to use which maximises the amount of information able to be encoded through a channel. Further investigations will be able to use these results as a baseline for other types of amplifiers being developed to infer their effectiveness in maintaining a discernible signal.

T25.

JAKSTAT signalling between mesenchymal stem cells and endothelial colony forming cells

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Background: The leading cause of death, globally, is cardiovascular diseases. To treat ischemic tissue, caused by cardiovascular disease, mesenchymal stem cells (MSC) and endothelial colony forming cells (ECFC) have been considered for vascular regenerative therapies, due to their ability to remodel and promote vasculature regeneration. By combinational therapies of ECFC and MSC, improved engraftment is observed. Literature also shows that the JAKSTAT signalling pathway may be a contributor between the cross-talk of ECFC and MSC, allowing enhanced engraftment. The aim of this investigation was to firstly, determine if co-culturing of ECFC with MSC, would show an upregulation within the JAKSTAT pathway. Methods and Results: Through quantitative reverse transcription PCR (RT-qPCR), this study found that contact-co-culture showed upregulation of gene expression in various JAKSTAT regulators. Following this, investigation into whether overexpression of STAT5a/STAT5b pathways in ECFC-MSCs modulate the host's immune system to improve cell survival and engraftment, in vivo. Adenovirus containing STAT5a, STAT5b or GFP were transduced into ECFC and these cells, along with MSC, were injected into a Matrigel plugs that were placed in immune competent mice. After 7days these plugs were harvested and stained for Lamin A/C and GFP. The quantification of the stained sections revealed that ECFC with STAT5a/b overexpression did not enhance the cell survival, in comparison to the control. Conclusion: ECFC and MSC cultured in-contact show an upregulation of genes that regulate the JAKSTAT pathway. In addition, overexpression of the STAT5a and STAT5b do not show improved cell survival in immune competent mice.

T26.

Blue space exposure and the implications for public health

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Exposure to natural environments has consistently been associated with improved wellbeing as well as a range of health benefits. Despite this, the types of natural environments studied have overwhelmingly been those classified as green spaces. While blue space has also been found to provide health benefiting qualities that promote physical activity, facilitate social cohesion, and improve mental health, research is limited and displays variable results. Recent reviews of the literature suggest that a large portion of current research faces significant methodological limitations. The predominant methodology in determining associations between health and blue space exposure relies on residential distance from blue space as a measure of exposure. While the farther a place of residence is from blue space the less likely those living there are to be aware of it, this is not necessarily true for if it will be accessed and used, or how frequently. The current primary methodological approach fails to acknowledge factors such as if the space is in fact utilised, how it is used, and how frequently it is used by visitors. Using a use-frequency based approach, this study aimed to evaluate the public health implications of frequent visitation of South Bank Parklands as a riverside, blue space. Findings from this study suggest a potential health benefiting role of blue space exposure. However, strong variations in results across the literature suggests that additional research into possible interplaying factors such as; environmental health, facility accessibility, and urban design influence is needed to provide further evidence of benefits.

T27.

Modelling beach erosion under sea level rise in the humid tropics

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Under climate change, sea level rise is increasingly driving beach erosion world-wide. This puts coastal development at risk. This risk needs to be quantified for appropriate management and adaptation. However, research to date has largely focused on New South Wales (nationally) and the USA (internationally), where beaches tend to be dominated by wave energy. Few concrete forecasts of beach erosion exist for low-energy tropical coastlines, such as Queensland. Yet the tropics are likely to be most vulnerable to erosion, as they tend to have small dunes, low volumes of sand, and are seasonally affected by cyclones.

This project investigated the future risk of erosion in the humid tropics of Queensland, using Clifton Beach (Cairns) as a case study site. A well-known morphodynamic model of shoreline change was calibrated to the site, and the erosion was forecast for different sea level rise scenarios to 2050, 2100 and 2300.

It was found that this type of model, while robust on wave-dominated coastlines, is extremely sensitive to parameter values on tropical coasts and largely unsuitable for this environment. However, even accounting for this conservatively, forecast erosion distances are very high and the case study beach drowns completely in the majority of forecast scenarios. These two findings highlight an urgent need to prioritise the tropics in future research on coastal erosion.

T28.

Partial haematopoietic stem cell depletion using c-kit-antibody-drug-conjugates allows targeted depletion and potentially safer autoimmune diabetes treatment

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Hematopoietic stem cell transplantation is widely applied for treatment of malignancies and immune diseases. It has also been applied to autoimmune diseases such as type 1 diabetes, in particular to deliver engineered hematopoietic stem cells (HSC). The procedure, however, involves myeloablative irradiation, which is toxic and dangerous to patients. Especially in asymptomatic humans with preclinical conditions, genotoxic irradiation is not acceptable. We reasoned that using antibody-drug-conjugates would result in safer pre-transplant conditioning and potentially enables effective transplantation. Here, we use antibody-saporin conjugates (2B8-SAP) targeting c-kit (CD117) - a cell surface marker expressing on HSC - to remove host HSC for pre-transplant conditioning. We demonstrated that at a low dose, partial depletion of HSC was observed in immunocompetent B6 mice, but not in nonobese diabetic (NOD) mice. 2B8-SAP treatment exerted its effects specifically on HSC while other immune cells were not affected. The results suggest that NOD mice are less sensitive to 2B8-SAP treatment. Based on our analysis, perhaps higher dose of 2B8-SAP is needed to exhibit the same depletion effect in B6 mice. Because 2B8-SAP preserves the host immune system, transplantation of engineered HSC could be facilitated in humans.

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