

2017 Bachelor of Philosophy (PhB) Symposium



5:00-7:00PM

25 August 2017

Sir Roland Wilson Building

Conference Room (1.02), The Australian National University,
Canberra, ACT 2600

[Presentation Abstracts \(in anticipated order\)](#)

1. Derailing the cancer train with the small-molecule inhibitor CX-5461

Lachlan Arthur (PhB Science)

Proteins are essential to the everyday functions of human cells; growth, repair, movement and division. In this case, surely eliminating the ability of cells to produce proteins would result in their death? Indeed it does, and now that scientists are able to inhibit the synthesis of ribosomes, the cellular machines that produce proteins, this concept forms the basis of some of the best up-and-coming cancer treatments. The problem is that many of these treatments are not targeted, meaning they will affect all cells in the body of a patient, not just cancer cells. Fortunately, it was

hypothesised by a group of scientists at the Peter MacCallum Cancer Centre in Melbourne that cancer cells, which rely heavily on proteins to grow and divide rapidly, will be more sensitive to treatments targeting ribosomes than 'normal' cells. Their theory functioned on the principle that 'protein-hungry' cancer cells would die before normal, healthy cells upon treatment. They were right, and now the small-molecule CX-5461, an inhibitor of RNA polymerase I transcription, is now in Stage I clinical trials as a cancer treatment. The drug appears to work miraculously well, however some tumours have been observed to develop resistance to CX-5461. This study aimed to explore the potential of multi-drug therapies to overcome acquired resistance to CX-5461 to establish its use as an effective anti-tumour therapy.

2. Avoiding catastrophe: dealing with *Toxoplasma gondii*

Hareesha Rangarajan (PhB Science)

Over 2 billion people worldwide and up to 8 million people in Australia are infected with toxoplasmosis. Immunodeficient and pregnant individuals are at the most risk of life-threatening infection. Developing a thorough understanding of *Toxoplasma gondii*, the parasite that causes this disease, is one step in creating therapies to target this condition. I localised a novel, purported ion transporter protein (now named CatCh) to the cell membrane of *T. gondii* parasites. I also made a mutant of the *T. gondii* that could not express the CatCh protein, and found that these mutants could not survive and infect other human cells. There is hence evidence to believe CatCh is essential to *T. gondii* growth. Because of its importance to *T. gondii* survival, and its location on the cell membrane, CatCh is now a potential drug target to combat toxoplasmosis.

3. What can maths tell us about democracy?

Mitchell Porter (PhB CASS)

Most of us think that we need democratic governments which hold free and fair elections. Elections are supposed to reveal the 'popular will,' or what voters want the government to do. But voting does not reveal what the people want at all, according to a number of 'social choice theorists.' Social choice theory is the mathematical study of how people collectively make decisions. Some theorists who take this approach argue that the idea of a 'popular will' revealed through elections is logically incoherent. The ordinary way we justify holding elections doesn't make any sense. My research asks the question: can maths really tell us about how we should design our political system? How can we talk in the language of maths about complex individuals living in even more complex societies? My research also looks whether social choice theory brings the whole idea of democracy into question. Isn't there more to democracy than voting? What about discussing policies, or participating in civic life? Can social choice theory show that there are problems with these practices, too? These are high-stakes questions. If social choice theorists are right, we may have to fundamentally rethink the way we do politics.

4. Pivoted Away: Asia after America

Aidan Myatt (PhB CAP)

When one dissects the tensions which currently confront Asia, one fact stands out. US regional leadership is on the chopping block. Above, it is the former "sick man of Asia", China, who is wielding the cleaver. In Asia, the Obama and Trump administrations lost the high ground to defend US regional primacy from an ambitious China. And under the leadership of Xi Jinping, the Red Dragon has begun to roar. What does this mean for Australia? Or for that matter Indonesia, Japan, Taiwan and India? Asia without a strategic US presence is alien to the majority of the world's population. My

research aimed to imagine the repercussions of the US withdrawing from Asia, conceptualising a new role for China as the heir apparent to US leadership and attempting to predict how security flashpoints, regional tensions and political agendas would respond. I conclude by considering whether the cost of resisting China's rise is worth the supposed benefits of US preponderance.

5. Order from chaos, the beauty of fractal geometry

Christopher Williams (PhB Science)

Classical mathematics normally assumes that everything is smooth, this trickles down to calculations used to model the real world but how often do you see a 'perfect' circle? What occurs in nature is rough, nothing is really a perfect straight line, but yet so many things are ordered in such a systematic way like leaves and trees. This is where the beauty of fractals comes in, achieving perfectly deterministic processes from chaos. The Sierpinski triangle is one of the most well-known fractals, but somewhat non-noteworthy due to the large amount of symmetries and completely determined features like fractal dimension. My ASC is on generalised Sierpinski triangles which consist of the original Sierpinski triangle and the previously well investigated Pedal triangle as well as two new fractal triangles discovered. I would like to talk generally about fractals as an introduction with the triangles found in my ASC as examples of fractals.

6. Inside the Chinese Keyword *sajiao*: The Art of Feminine Persuasion

Jessy Wu (PhB CASS)

There is a close connection between the life of a society and the lexicon of the language it speaks - through interrogating the meaning and the significance of certain cultural keywords, we can unearth valuable insights about a given speech community. My essay focuses on the Chinese keyword 撒娇 (*sajiao*), a phrase typically translated into English as “to act like a spoiled child”, “to throw a tantrum”, or “to act coquettishly”. I suggest these translations are overly narrow and do not accurately represent how Chinese speakers understand and use the phrase. To produce a more nuanced translation, I review Chinese dictionary definitions of *sajiao* and analyse examples of the phrase being used in conversation and in writing. The examples include excerpts from a mother’s interaction with her young child and clippings from Chinese tabloid newspapers. With reference to this linguistic data, I use Anna Wierzbicka’s natural semantic metalanguage (NSM) approach to explicate the phrase. This approach attempts to explain complex, culture-specific concepts in simple, universal terms, using a vocabulary of 64 words (known as semantic primes) whose meanings cannot be decomposed further. My explication suggests *sajiao* prototypically involves someone (usually a child or a young woman) projecting a sense of helplessness and dependency to win the affection of someone else, in order to persuade this person to do a favour for them. Importantly, *sajiao* is a deliberate and calculated action designed to elicit a certain response, as opposed to the uncontrolled outburst of emotion implied by the English gloss “to throw a tantrum”. This explication can help us to better appreciate the significance of the cultural keyword *sajiao*, and provide a key to understanding how Chinese speakers navigate power relations, persuade others, and construe gender roles.

7. Perfect isolation: A study of vibration measurement and cancelation

Timothy Hume (PhB Science)

Atom interferometers exploit the wave nature of matter as the technological basis for ultra-precise sensors. These devices operate by interferometrically measuring the change in position of an atomic

test mass with a standing wave of light. The degree of isolation between a suspended inertial test mass (a mirror that generates the standing wave) and the surrounding environment is a limiting factor in the precision achieved by these sensors. The high precision gravity sensor at the ANU has potential applications in navigational systems and mineral exploration. This project aims to design and implement a new active mechanism for vibration isolation of the inertial test mass. The project will deliver the basis for an isolation system that supersedes the geometric anti-spring (GAS) currently in use on the ANU gravity sensor. In particular, this will involve testing of a recently developed optical accelerometer, in order to measure its transfer function so that it may be implemented in the new active isolator design.

8. Positron moderation and production in supernovae dust grains

Ella Xi Wang (PhB Science)

For half a century we have detected positrons from the Milky Way. Where do these anti-particles come from? Supernovae as a possible source of positron production were considered, but they were eliminated previously. Now, new data brings back the possibility. A one dimensional model was made in Python looking at the moderation of positrons within silicon carbide dust grains, predicting a moderation efficiency of 5×10^{-3} , amongst some of the highest seen in laboratories on Earth. The next step is to look at how low-energy positrons propagate through the interstellar medium.

9. Mapping tourism potential on the Yawuru estate

Mia Sandgren (PhB CASS)

The Yawuru community hold Native Title rights for areas in and around Broome, Western Australia. Nyamba Buru Yawuru (NBY), the organisation that represents the wider Yawuru community, wishes to expand tourism on their estate as means of both sharing and showing their Country and achieving socio-economic outcomes for the community. Tourism has the potential to be a part of the development strategy for Indigenous peoples, potentially forming part of novel “hybrid economies” (Altman, 2001). However, tourism can also have unintended and detrimental consequences for both the environment and communities that host tourist developments. Consequently, strategic planning is required to ensure that the consequences of tourism do not outweigh the benefits. This research aims to use Geographic Information Systems (GIS) to create a model to guide tourism planning on Roebuck Plains Station, a section of the Yawuru Indigenous Protected Area. Sketch mapping interviews with representatives of the Yawuru community are used to define Yawuru tourism priorities for the Roebuck Plains Station and create a spatial model of these priorities. The model is integrated with existing data sets to define areas of conflicting and complimentary values and areas most appropriate for tourism. This model demonstrates the capacity of GIS to represent Indigenous knowledge and provide decision-support for development planning. This research is conducted in partnership with Yawuru community and is a unique application of GIS to tourism planning in a community-integrated, Australian Indigenous context.

10. “My Poem’s Epic”: *Don Juan*, Epic and History

Lucinda Janson (PhB CASS)

Lord Byron’s epic *Don Juan* employs the conventions of ancient and modern epic poetry, yet more often subverts and playfully deconstructs the genre. *Don Juan* is a poem of love, war and adventure, and its traditional epic themes are set against the backdrop of the military and political upheavals of late-eighteenth-century Europe. My research explores the ways in which Byron’s use and subversion of epic codes enable him to critique both ancient poetry and also contemporary politics, literary

traditions and gender relations. Byron's juxtaposition of past and present allows him to reveal the unchanging cruelties of war and to attack political despotism and tyranny both ancient and modern. Moreover, Byron questions the nature of heroism, by downplaying the martial aspects of epic adventure in favour of the trivial and the amorous. Against the virile heroic ideal, Juan is portrayed as a passive and feckless young man, largely at the mercies of rapacious women. Although Byron thus destabilises traditional gender roles, his portrayal of active heroines exposes both a traditional fear of powerful women and a libertine fantasy of women's sexual willingness. Yet *Don Juan* is ultimately most preoccupied with the act of writing poetry and history. Byron places the narrator at the centre of *Don Juan*, and his digressive and satiric style forms the heart of the poem's challenge to epic seriousness. Byron thus positions the heroic poet at the centre of history and of epic, allowing him to posit a new, literary form of heroism.

11. Taking ACTION on Safety

Matthew Flower (PhB Science)

For many of us, taking public transport - Canberra's famous ACTION bus network - is an important part of everyday life. It might connect you to school or extension classes, extracurricular activities, and social or recreational pursuits. The reality is that many of these trips, especially in winter, will take place when it is late at night or at least when it's dark. You'll probably have to walk some distance home from your nearest bus or inter-town stop. How well-lit is your trip home, and how far must you walk? Are you likely to feel safe traveling in those lighting conditions, for the necessary distance? This project uses GIS (Geographic Information Systems) to spatially analyse lighting conditions, together with distances to residential addresses, from bus stops across the ACT. The output is a predictive safety surface - a map which forecasts the relative likelihood of an individual feeling safe walking to/from their nearest bus stop under the cover of darkness.

12. Development of a Pulsed Neutron Beam to Measure the Quenching Factor of Scintillating Crystals

Daniel Lawson (PhB Science)

In high school I was mainly interested in two areas of physics, nuclear physics and astrophysics. The PhB program introduced me to the intersection of these two disciplines and allowed me to simultaneously conduct research into both disciplines through their undergraduate research courses. In semester two of 2nd year, I worked with the ANU Nuclear Physics Department on the beginning of a project which hopes to provide conclusive evidence for the particle form of dark matter. Taking the university's particle accelerator to energy extremes that it hasn't seen in at least a decade, we were able to create a pulsed neutron beam for the purposes of calibrating the crystals which will eventually be used for dark matter detection. In first semester of second year, I brought my interests down to earth a bit more, to Low Earth Orbit. I worked with the ANU's Centre for Plasma Fluids and performed diagnostic tests on their Mini-RF Plasma Thruster, which have in the past been deployed on small satellites, known as CubeSats. This technology even shows promise of transporting humans to Mars, which attracted the media's attention about a year ago.

13. Digital investigations into Raynal and the *Histoire des Deux Indes*

Harry Dalton (PhB CASS)

A renegade clergyman, resourceful journalist, and subversive author, Guillaume Thomas Raynal was an intriguing character of the French eighteenth century. His 1770 work, the *Histoire Philosophique et Politique des Établissements des Européens dans les deux Indes* was undoubtedly one of the most

influential texts of the Enlightenment. Although it has long since lost the best-seller status it achieved in the late 1700s, it nonetheless must be regarded as one of the most substantial works of the pre-revolutionary era and one of the most radical contributions to the body of *philosophie* criticism of the *ancien regime* and its economic, religious, and political systems. This project used digital research methods to investigate the response to Raynal and his *Histoire des deux Indes* in North America in the latter decades of the eighteenth century (1770-1800), with a particular focus on how Raynal's work intersected with the American Revolution and the founding of the United States. Drawing on modern database resources the paper thus traces the reception of a significant text in the twilight of the Enlightenment, seeking to gauge its influence at the dawn of the age of revolutions.

14. Voice: The Struggle to Keep Humanities Human

Rosalind Moran (PhB CASS)

In 2016, American author Lionel Shriver made headlines saying "I hope the concept of cultural appropriation is a passing fad." Her words added fuel not only to discussions on authorship and authenticity in literature, but also to debates surrounding identity politics in general. The politics of voice have gained significant attention on university campuses, particularly in the Arts. Yet there has also been a backlash against this movement with consternation over 'millennials' and the development of a fragile 'snowflake generation'. It is therefore more topical than ever to ask ourselves why voice has become so emphasised and politicised. Who gets to write which story, and why does this matter?