ANNUAL REPORT 2018

AINSE

The Australian Institute of Nuclear Science and Engineering

Playing a leading role in nuclear **Education** and training

Stimulating and **Supporting** students and early-career researchers in pursuing a career in nuclear science and engineering

Facilitating **Collaborations** with researchers at ANSTO's landmark infrastructure

Providing an effective **Network** between all stakeholders of nuclear science and engineering

Engaging with **Members** to enhance funding opportunities and ensure relevance of nuclear education and training

AINSE
THE AUSTRALIAN INSTITUTE OF NUCLEAR SCIENCE AND ENGINEERING
New Illawarra Road, Lucas Heights NSW 2234 Australia
+61 2 9717 3376 | ainse@ainse.edu.au | www.ainse.edu.au
ABN 18 133 225 331

CONTENTS

AINSE 2018 Annual Report

From the President and the Managing Director

AINSE began 2018 with numerous opportunities for members to increase their benefits, largely through a suite of new programs implemented in 2017. These new and continuing programs included the Scholarship AINSE ANSTO French Embassy (SAAFE) research internship program, the Residential Student Scholarship (RSS), the AINSE Women in STEM and Entrepreneurship (WISE) School, and the Japan Particle Therapy Tour. Meanwhile, support continued for AINSE's large traditional programs: Honours Scholarships, Postgraduate Research Awards (PGRAs), the Winter School, and the PGRA Orientation Week.

Early in the year the AINSE Managing Director was invited to present on behalf of ANSTO and AINSE at the International Meeting on Human Resources Development for Nuclear Energy in Asia (Fukui Prefecture, Japan). Following the success of this meeting and interest expressed by the attendees, AINSE has participated in subsequent discussions about further interactions with Japanese contacts in this field. A delegate from Kindai University, Japan, followed up with a visit to ANSTO and AINSE in October.

In 2018, thirty-four students from eighteen Universities were successful in their bids to receive honours scholarships for support during their research time at ANSTO. An additional thirty-one students from fifteen Universities were awarded PGRAs in support of their PhD studies. This brought the 2018 cohort of PhD students to eighty-seven. New students were invited to attend an orientation week in October to meet their colleagues and learn about the potential for collaboration across the various ANSTO facilities. Students at this event also participated in Nuclear Science Week, an annual global celebration organised by the National Museum of Nuclear Science and History in Albuquerque. The new AINSE PhD student cohort was able to attend the Australian celebration, organised by AINSE with assistance from the Australian Young Generation in Nuclear (AusYGN) and the Women in Nuclear Australia chapter (AusWiN).

The RSS program approved six more students in 2018 to be onsite at an ANSTO location for up to six months in order to further their project goals. These opportunities are specifically tailored to support students undertaking long-term strategic projects at ANSTO facilities. All of the successful students are working on projects closely aligned with ANSTO's research programs: Environment, Human Health, and the Nuclear Fuel Cycle.

The AINSE Winter School was expanded again in 2018 to accommodate more places, with fifty-eight students attending from forty-two member institutions. Theranostics Australia and the Vacuum Society of Australia each offered their Winter School positions to a student from a nominated University. As AINSE diversifies its membership and stakeholder base, it was pleasing that both of our industry members were able to better utilise their benefits by nominating a University with which they were collaborating to have an additional place at the school. Our other institutional members, Defence Science Technology Group and CSIRO, also sent early career researchers to participate.

In 2018 the second round of the SAAFE program saw four students approved to travel either from Australia to France or from France to Australia. The students that travelled in 2018 were Gabriel Murphy from the University of Sydney, who was hosted by Centralesupelec University, and Izabella Zahradnik from CEA-LIST Diamond Sensors Laboratory in France, who undertook research with ANSTO and the University of Wollongong.

In August, AINSE conducted a study tour in Japan to investigate particle therapy. Throughout the tour, delegates were able to discover how Japan has developed particle therapy from the early experimental stages through to patient treatments in a hospital setting. AINSE hosted this educational tour with assistance from Physicist Dr Dale Prokopovich from ANSTO.

In December the second annual AINSE WISE School was held, with attendance increased to fifty-seven students from thirty-two Universities. The School received in-kind support from ANSTO and funding from the NSW government through the Research Attraction and Acceleration Program (RAAP).

In other news, AINSE supported twenty-one students from twelve universities to attend twenty-three international conferences. AINSE international travel scholarship support is intended for students that have an ANSTO researcher as a co-author on their conference poster or oral presentation.

The end-of-year highlight was the celebration of AINSE's 60th Birthday, with a dinner hosted at the Australian Museum. We welcomed our current AINSE member representatives, University and ANSTO delegates, and notable alumni to this event. We would like to take this opportunity to thank Mr Bill Palmer (OBE), first Scientific Secretary and Executive Officer of AINSE, for his speech about

AINSE Managing Director Michelle Durant (front row, far left) and the delegates of the 8th International Meeting on Human Resources Development for Nuclear Energy in Asia (Fukui Prefecture, Japan, February 2018).

the beginnings of AINSE, and Dr Dennis Mather for his account of the challenges faced by AINSE over the fourteen years he served as Managing Director. Dr Simone Richter spoke on behalf of ANSTO and highlighted the connections between AINSE and ANSTO over many years of fruitful collaboration. The evening concluded with a thoughtful account of life in research from Professor John White, former AINSE President in 1995.

Dr Richard Garrett and Professor Lyndon Edwards both retired from the Board in 2018, and we thank them for their contributions and stewardship of AINSE throughout their tenure. They both provided great insights to the business during significant times of change. We also acknowledge and appreciate their continued support since leaving the Board.

Ms Elizabeth Geyer left AINSE in 2018 and we thank her for her efforts as the Communications & Events Coordinator. Our new Communications & Events Coordinator, Dr Michael Rose, took up the role in October and utilised his former experience at ANSTO to expand our social media and external promotions in only a few months. We also thank Mr Paul Graydon, Business Manager, and Mr Joshua Keegan, our Casual Administration Assistant, for their stellar efforts throughout 2018. Mrs Nerissa Phillips is to be thanked for her enduring commitment to AINSE, with 2018 marking her twenty-fourth year at AINSE. We finished the year by saying farewell to AINSE's longest serving staff member, Mrs Sandra O'Connor, who left AINSE in December 2018. Sandy had been part of the AINSE team for 25 years, and we thank her for that long commitment to AINSE.

Further thanks should be extended to Dr Adi Paterson and his team for allowing AINSE to utilise ANSTO facilities, and the expertise of related staff in our continued efforts to promote ANSTO programs and the importance of ANSTO's research potential. ANSTO staff have been so committed to assisting AINSE with supervising students, running schools, providing expertise and mentorship, along with many other activities. We also thank our member representatives for supporting us throughout the year. We rely on our members to assist with the promotion of our programs and the utilisation of the available member benefits, and are grateful for this continued support.

AINSE finished 2018 with a $76,864 surplus, largely due to underspent travel in the PhD program and reduced staff costs. This followed a surplus in 2017 and we are pleased to maintain this business surplus with the goal of returning these funds to members via the benefits AINSE offers. We look forward to consulting the members with regards to how best to capitalise on this strong financial position.

Toward the end of the year the Board developed a new strategic plan that was approved by members in the November general meeting. The plan accommodates changes AINSE has made in moving away from a facility-access focus to development of increased collaborative potential for members. We look forward to bringing this plan to fruition in the years to follow.

Claire Lenehan (signature)

Prof. Claire Lenehan
AINSE President

M Durant (signature)

Ms. Michelle Durant
AINSE Managing Director

AINSE Board 2018

Prof. Claire Lenehan
President
University Representative

Ms. Michelle Durant
Managing Director

Dr. Peter Coldrey
Independent Director

Mrs. Helen Liossis
Independent Director

Prof. Ian Gentle
University Representative

Prof. Roland De Marco
University Representative

Ms. Roslyn Hatton
ANSTO Representative

Prof. Andrew Peele
ANSTO Representative

Dr. Suzanne Hollins
ANSTO Representative

Board Members who concluded their service in 2018:

Dr. Richard Garrett
ANSTO Representative
Concluded 20th January 2018

Prof. Lyndon Edwards
ANSTO Representative
Concluded 1st May 2018

AINSE Staff:

Managing Director:

Michelle Durant, BSc, BFinAdmin, GradDipAppCorpGov, FGIA, FCIS

Secretariat:

- **Paul Graydon**, BEc, CPA
- **Michael Rose**, BSc, BMath(Hons), PhD, MScom
  Commenced October 2018
- **Nerissa Phillips** (part-time)
- **Joshua Keegan** (casual)
- **Elizabeth Geyer**, Cert. Comm (ASCA), BA, BArtTh(Hons), MArtAdmin
  Concluded August 2018
- **Sandra O'Connor** (part-time)
  Concluded December 2018

Strategic Directions

Our Vision

Enhancing Australia's capability in nuclear science and engineering by facilitating world-class research and education.

Our Mission

AINSE will reach its vision through:

Playing a leading role in nuclear education and training;

Plaing an advocacy role for the Australiasian nuclear community;

Being an effective link between all stakeholders of nuclear science and engineering;

Facilitating the development of multilateral and multidisciplinary strategic research initiatives; and

Utilising new streams of funding to increase impact.

Our Strategic Priorities

Diversify AINSE's membership and stakeholder base.

Seize new opportunities for funding beyond AINSE's traditional sources.

Provide an effective and efficient link between different capabilities related to nuclear science and engineering.

Develop AINSE's role as a credible advocate for the Australisian nuclear science and engineering community.

Demonstrate leadership in the education of Australiasia's next generation of scientists with an interest in nuclear science and engineering.

Create an appropriate balance between funding project-based research and funding/facilitating multilateral and multidisciplinary collaboration.

Effectively communicate AINSE's purpose to a wide range of different stakeholders.

Above: PGRA student Andrew Jones on a field trip to Fraser Island (left) and analysing soil enzyme activity (right). Below: PGRA student Kaitlyn O'Mara collecting shrimp from the Bremer River to trace catchment metal influences on estuarine organisms.

Research Highlights

Dating Aboriginal rock art shelters in the Kimberley region using cosmogenic nuclides

Gael Cazes[1,2], David Fink[1,2], Réka-Hajnalka Fülöp[1,2], Alexandru T. Codilean[1,3], Toshiyuki Fujioka[2], Klaus M. Wilcken[2]

[1] School of Earth, Atmospheric and Life Sciences, The University of Wollongong, Wollongong, NSW, Australia.

[2] Nuclear Science & Technology and Landmark Infrastructure (NSTLI), ANSTO, Lucas Heights, NSW, Australia.

[3] ARC Centre of Excellence for Australian Biodiversity and Heritage, The University of Wollongong, Wollongong, NSW, Australia.

The Kimberley region of Western Australia is well-known for its rich and diverse collection of rock art and is characterised by one of the highest concentrations of recorded sites globally.

Rock art is a key element of Aboriginal cultural heritage, representing community, recognition of rituals, and the cognitive development of modern humans through time. However, dating the art itself remains a significant challenge for archaeologists. This is particularly true in the Kimberley region, due to the dominance of non-organic ochre pigments that do not allow the use of well-established radiocarbon dating methods and the non-calcareous substrate that limits the efficacy of uranium series dating.

The failure of these techniques becomes more critical given that all Kimberley rock art is found in partially-exposed walls of rock shelters. The art itself is therefore exposed to the elements, unlike the case for European rock art sites that are far more protected in closed caves. These limitations have resulted in a paucity of reliably-dated sites (Aubert 2012) and the largely accepted relative chronology of the Kimberley rock art, based on style and subject matter (Walsh and Morwood, 1999), still clearly lacks absolute chronological anchors.

As a proof of concept, this technique was employed at seven different sites to date shelter formation events ranging from approximately 9,000 to 230,000 years ago...

To this end, a multi-disciplinary research programme funded by the Australian Research Council Linkage Grant (LP130100501) (Green et al., 2017) with strong financial and logistical support from the Kimberley Foundation of Australia was initiated, with the main objective of developing a new dating method, called cosmogenic exposure dating, as well as developing new methods of available and independent dating techniques that, taken together, can provide constraining ages to Kimberley Aboriginal rock art.

Figure 1: The DRY13 rock art shelter, known as ''the large macropod'', a 15m wide panel with a substantial number of paintings. This rock shelter was formed after the collapse and ejection of the large block of sandstone at the bottom right corner of the picture due to chemical rock weathering in jointing fractures along the faces of the intact slab. Surface rock samples were collected for cosmogenic nuclide analyses at ANSTO from the upper face of the fallen slab and also on the ceiling from where is was detached. In this case the slab release age provides a maximum age for the art. Photo credit: R.H. Fülöp.

Cosmogenic surface exposure dating is based on cosmic rays that penetrate Earth's atmosphere, bombarding rock surfaces and creating long lived radionuclides such as ^{10}Be and ^{26}Al. The longer the surface is bombarded by cosmic rays, the higher the cosmogenic radionuclide concentration. Thus, when measured by Accelerator Mass Spectrometry, the cosmogenic radionuclide concentration can be used as an indicator of how long the surface has been exposed. Our team of specialists in applications of cosmogenic nuclides and landscape geomorphology from ANSTO and the University of Wollongong applied this new dating technique to date the age of formation of rock art shelters.

As a first step, we completed a regional landscape evolution study by analysing ^{10}Be and ^{26}Al cosmogenic nuclides in modern river sediments and bedrock surfaces throughout the Kimberley plateau. Our results showed that the prominent sandstone escarpments and river channel gorges, where most of the rock-art sites are found, are not as quiescent as would be expected in this flat-lying, tectonically passive, slowly-eroding landscape (Cazes et al., 2018, in review). This finding posed the question of whether the cantilevered ceiling slabs of rock shelters, located at the base of these actively-retreating scarps, might not be sufficiently stable structures to preserve Aboriginal rock art over the past 60,000 years of Aboriginal presence in the Kimberley.

These shelters are characterised by cantilevered overhangs and evolve through the collapse of unstable blocks typically weakened along joint-lines and fractures. On release, those slabs which extend outside the rock face perimeter will experience a higher production

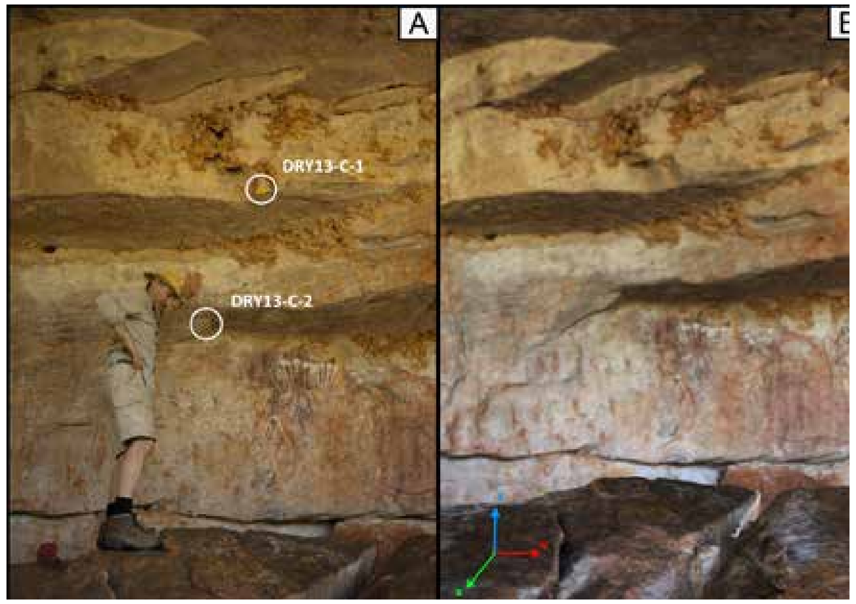


Figure 2: A comparison between a photograph looking at the back wall of the same shelter (a), with the corresponding view of the final high resolution meshed and texturized model (b) used in the age calculation. White circles show ceiling sample locations, which are the points of contact of the ceiling slab with the ceiling prior to detachment. Comparison of the measured concentration between the ceiling and respective slab locations enables calculation of a rock slab release age. Photo credit: R.H. Fülöp.

rate of cosmogenic isotopes than the adjacent rock, which remains intact within the shelter. The dating of these freshly exposed slabs, by combining cosmogenic nuclide analyses with 3D modelling using a photogrammetry approach based on drone surveys, can help reconstruct rock-shelter formation and provide age brackets for the art.

As a proof of concept, this technique was employed at seven different sites to date shelter formation events ranging from approximately 9,000 to 230,000 years ago, which can be interpreted as a minimum and/or maximum age for the art depending on the relative positioning of the art within the shelter compared to the fallen ejected slab. Additional archaeological sites were sampled during our last 2018 field trip and more age constraints will be available in the near future.

Combined with the other innovative methods developed in this large-scale project (i.e. radiocarbon and OSL dating of mud wasp nests and multi-element mineral accretion dating), this approach could ultimately lead to a better understanding of the antiquity and the evolution of rock art and rock art styles in the Kimberley, and potentially beyond.

The authors acknowledge financial support from AINSE (PGRA 12027 granted to Gael Cazes), the Australian Research Council, and the Kimberley Foundation Australia. We thank the Western Australian Department of Aboriginal Affairs and Department of Parks and Wildlife for sampling permits, and the Traditional Owners of the Kimberley for permission to collect samples and their assistance and guidance during fieldwork.

References:

Aubert, M 2012, 'A review of rock art dating in the Kimberley, Western Australia', *Journal of Archaeological Science* vol. 39 no. 3 pp. 573–577.

Cazes, G, Fink, D, Codilean, A T, Fülöp, R H, Fujioka, T & Wilcken, K M (in review), 'Erosion of sandstone escarpments are a major source of basin sediment budgets in the Kimberley, NW Australia, revealed by cosmogenic ^{10}Be and ^{26}Al', submitted to *Earth Surface Processes and Landforms*.

Green, H, Gleadow, A & Finch, D 2017, 'Characterisation of mineral deposition systems associated with rock art in the Kimberley region of northwest Australia.' *Data in Brief,* vol. 14, pp. 813–835.

Walsh, G 2000, 'Bradshaw art of the Kimberley', Takarakka Nowan Kas Publications.

A global doubling of dust emissions during the Anthropocene?

James Hooper[1], Samuel Marx[1]

[1] GeoQuEST Research Centre - School of Earth and Environmental Sciences, The University of Wollongong, Wollongong, NSW, Australia.

Expansion and intensification of human land use during the Anthropocene has been found to match an increase in dust flux in a number of sedimentary archives around the globe.

The loss of soil associated with this change presents a serious challenge to soil security, while the increased dust load in the atmosphere is likely to have had a recognisable impact on biogeochemical cycles and the earth's climate.

For example, dust is a major source of nutrients to remote ocean environments, influencing primary productivity (PP). Enhanced oceanic PP causes drawdown of atmospheric CO_2, and is considered likely to be a driver of climate variability on glacial-interglacial timeframes.

To further investigate the impact of human activity on dust flux since the beginning of the Industrial Revolution (1750 CE), a statistical analysis was performed on the levels of dust deposition recorded within 25 sedimentary records. These records were compiled from around the globe based on specified criteria for continuity, duration and resolution.

The timing of an increase in dust deposition in many of the cores coincided with the introduction and intensification of modern industrial agriculture in the dust source regions supplying dust to the core sites, allowing us to calculate an average increase in dust emissions due to the intensification of human activity. Our results show that globally, dust emissions increased by a factor of 2.1 times after the Industrial Revolution (1750 CE).

Data compiled from other study types, such as remote sensing, airborne sediment sampling, and meteorological station records, also show increases in anthropogenic dust levels. These additional studies, which follow the onset of industrial agriculture, and so are more likely to be distorted by short-term climate variability, suggest human activity has increased dust emissions by a factor of between 1.3 to 45 times.

Our results show that, globally, dust emissions increased by a factor of 2.1 times after the Industrial Revolution (1750 CE).

Further research will focus on creating new dust records from sedimentary archives in regions currently lacking coverage, as well as understanding what impacts this recent increase in dust flux may have had on recipient ecosystems and environments.

Archaeology, Geosciences and Environmental Sciences AGES

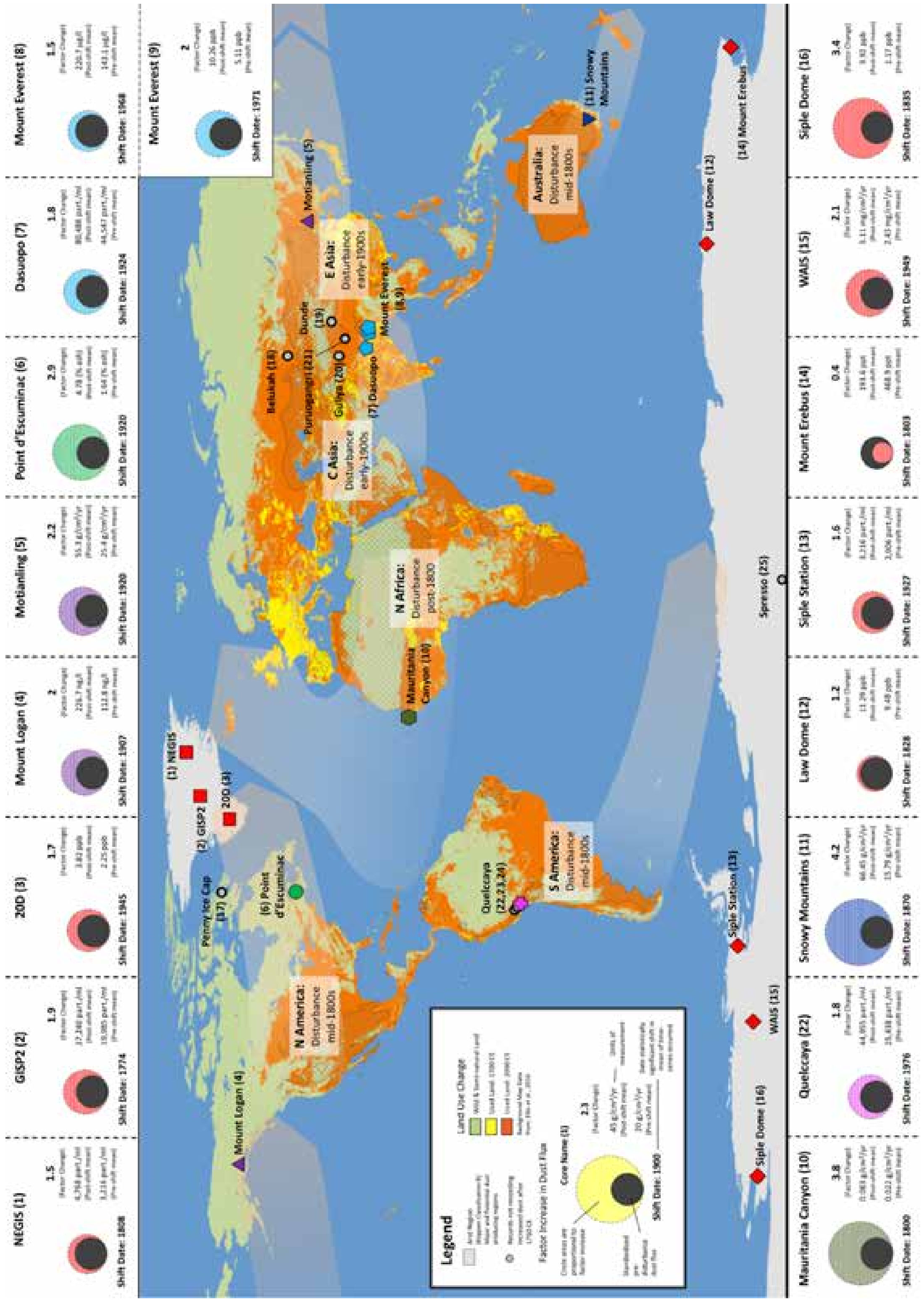


Figure 1: The timing and factor change (AEFA) in detected mean shifts in dust deposition for the 17 archives that recorded a significant shift post-1750 CE. AEFA is the Anthropogenic Emissions Factor Anomaly, or the increase in dust flux that is likely attributable to human disturbance. The colour of each sedimentary archive represents the most likely source area contributing dust to that site based on known major dust plume pathways as outlined in Shao et al. (2011; Fig. 6) and Muhs (2013; Fig. 8), where dark green = North African sources, light blue = Central/South Asian, purple = East Asian, light green = North American, pink = South American and dark blue = Australian. Red is used for sedimentary records in Greenland and Antarctica where the archives may receive dust from multiple sources. The location of the eight additional records which did not record a significant shift in dust deposition are also indicated on the figure (small grey circles). Landuse change data are derived from Ellis et al., (2010), where used land denotes croplands, rangelands agricultural villages and urban land. Arid Regions, are based on Köppen Climate Classification B (arid) (data from Peel et al., 2006). These broadly represent the major dust source regions (e.g. see Ginoux et al., 2012).

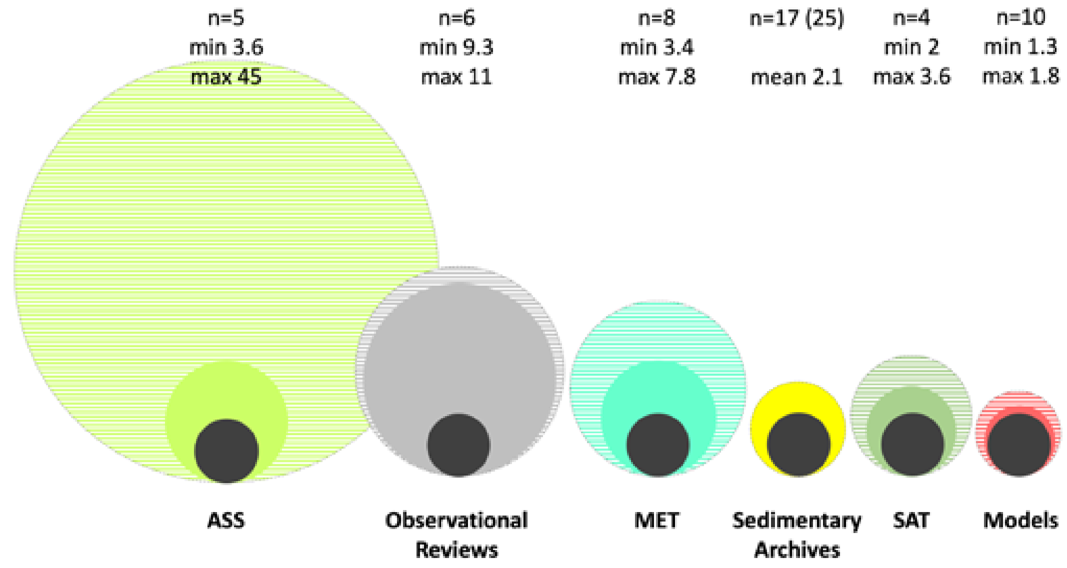


Figure 2: The maximum and minimum Anthropogenic Emissions Factor Anomaly (AEFA) increase in dust emissions due to human disturbance across all six study types considered in this paper. Above each study is a value for n (the number of studies considered for that study type), min (the average of the minimum AEFA across all of the studies considered for that study type), and max (the average of the maximum AEFA increase across all of the studies considered for that study type). Black circles represent the standardised pre-disturbance dust emission (pre-disturbance=1), solid colour circles represent the minimum average, and striped circles represent the maximum average post-disturbance dust emission factor increases respectively, for each study type. Circle areas are proportional to the dust emission factor increase in comparison to the standardised black circles..

We would like to thank AINSE for providing support for this project through a Postgraduate Research Award. The assistance of the team at the ANSTO Institute of Environmental Research—especially Atun Zawadzki, Henk Heijnis, Patricia Gadd and Krystyna Saunders for their help with ^{210}Pb dating, ITRAX core scanning and project guidance—has been hugely appreciated. We would also like to thank Geraldine Jacobsen and Alan Williams for their assistance with ^{14}C radiocarbon AMS dating, David Child and Michael Hotchkis for Pu and U isotope analyses, and Matthew Fischer for support with statistical analyses.

References:

Ellis, E C, Goldewijk, K K, Siebert, S, Lightman, D & Ramankutty, N 2010, 'Anthropogenic transformation of the biomes, 1700 to 2000', *Global Ecology and Biogeography*, vol. 19, pp. 589–606.

Ginoux, P, Prospero, J M, Gill, T E, Hsu, N C & Zhao, M 2012, 'Global-scale attribution of anthropogenic and natural dust sources and their emission rates based on modis deep blue aerosol products', *Review of Geophysics*, vol. 50, no. 3, pp. 1–36.

Muhs, D R 2013, 'The geologic records of dust in the quaternary', *Aeolian Research*, vol. 9, pp.3–48.

Peel, M C, Finlayson, B L & McMahon, T A 2006, 'Updated world map of the Köppen-Geiger climate classification', *Meteorologische Zeitschrift*, vol. 15, pp. 259–263.

Shao, Y, Wyrwoll, K H, Chappell, A, Huang, J, Lin, Z, McTainsh, G H, Mikami, M, Tanaka, T Y, Wang, X & Yoon, S 2011, 'Dust cycle: An emerging core theme in Earth system science', *Aeolian Research*, vol. 2, pp.181–204.

Biogeochemical mechanisms driving soil carbon stability in the Cooloola sand dune

Andrew Jones[1,2,3], Ram C. Dalal[1], Geraldine E. Jacobsen[4], Stuart Grandy[5], Susanne Schmidt[1], Vadakattu Gupta[3], Jonathan Sanderman[6]

[1] School of Agriculture and Food Science, The University of Queensland, St. Lucia, QLD, Australia.

[2] Department of Environment and Science, Queensland Government, Eco Sciences Precinct, Dutton Park, QLD, Australia.

[3] CSIRO Agriculture, Glen Osmond, SA, Australia.

[4] Nuclear Science & Technology and Landmark Infrastructure (NSTLI), ANSTO, Lucas Heights, NSW, Australia.

[5] Department of Natural Resources and the Environment, University of New Hampshire, Durham, New Hampshire, USA.

[6] Woods Hole Research Centre, Falmouth, Massachusetts, USA..

Globally, soils contain approximately three times more carbon than the atmosphere, and the annual flux of carbon between the soil and the atmosphere is about eight times greater than the sum of all anthropogenic emissions (Schlesinger & Andrew, 2000).

Consequently significant efforts are being directed to understanding the controls on the decomposition of soil organic matter (SOM) as they determine the fate of carbon. In particular, radiocarbon dating studies have revealed that SOM stored in deep subsoils is considerably more stable than SOM in the shallower surface, but the processes of this stabilisation are not clear (Kaiser & Kalbitz 2012).

Deep subsoil SOM is potentially rich in nutrients and highly palatable for microbial decomposition. Despite this, it does not completely decompose—as indicated by universally observed increasing SOM turnover time (i.e. radiocarbon age) with depth (Sanderman & Amundson 2008; Kaiser & Kalbitz 2012).

It is not known whether this lack of decomposition is a result of unfavourable environmental conditions, mineral protection of organic matter, or carbon substrate limitations due to the distance from plant inputs.

In this study, we are assessing the biogeochemical mechanisms driving ancient SOM stability in deep B-horizons of a giant podzol chronosequence, the Cooloola sand dune chronosequence in Queensland, Australia. The chronosequence is characterised by a sequence of spodic B-horizons of increasing depth from 0.5m to 15m with overlying leached E-horizons comprised of weathered quartz grains, likewise extending with dune age (Thompson 1991).

The chronosequence therefore provides a unique model system to track depth-related changes to SOM composition and stability in the mineral-rich B-horizon in the subsoil depths that have only rarely been characterised until now (Skjemstad et al. 1992).

Categorising products from pyrolysis gas chromatography mass spectrometry into their respective plant and microbial origins reveals a clear transition in SOM composition from primarily plant-derived SOM (lignins and polysaccharides) in surface soil to more processed SOM (aromatics) in the deeper B horizons. This change in chemical makeup was accompanied by increasing SOM radiocarbon age with depth, indicating that the stabilisation of SOM is generally associated with processed, aromatic materials.

...a unique model system to track depth-related changes... in the subsoil depths that have only rarely been characterised until now.

Aromatic compounds in SOM can be attributed to sources that include long-term humification, fungi-related decomposition and fire-derived charcoal. We aim to further explore the origin of these deep SOM aromatics – specifically, whether SOM aromatics are fire-derived material leached through the soil profile and accumulated in the deep B horizons, or are the result of long-term SOM humification processes.

It is a privilege to conduct research at Cooloola, building on the legacy of CSIRO research there in the 1970s-1990s. I am very grateful for the continued support from AINSE since the beginning of my research career in 2012 (ALNGRA12038 and 2015 AINSE Postgraduate Research Award), and from CSIRO and the Queensland Government's Department of Environment and Science.

Figure 1: A collection of soil samples taken from Cooloola sand dune.

References:

Kaiser, K & Karsten, K 2012, 'Cycling downwards–dissolved organic matter in soils', *Soil Biology and Biochemistry*, vol. 52, pp. 29–32.

Sanderman, J & Ronald, A 2008 'A comparative study of dissolved organic carbon transport and stabilization in California forest and grassland soils', *Biogeochemistry*, vol. 89, no. 3, pp. 309–327.

Schlesinger, W & Jeffrey, A 2000, 'Soil respiration and the global carbon cycle', *Biogeochemistry*, vol. 48, no. 1, pp. 7–20.

Figure 2: Field trip to Fraser Island.

Skjemstad, J O 1992, 'Genesis of podzols on coastal dunes in southern Queensland. III. The role of aluminium organic complexes in profile development', *Soil Research*, vol. 30, no. 5, pp. 645–665.

Thompson, C H 1981, 'Podzol chronosequences on coastal dunes of eastern Australia', *Nature*, vol. 291, no. 5810, pp. 59–61.

Archaeology, Geosciences and Environmental Sciences AGES

Revealing the hidden past of Tasmanian landscapes

Michela Mariani[1], Simon E. Connor[1,2], Michael-S. Fletcher[1], Martin Theuerkauf[3], Petr Kuneš[4], Geraldine Jacobsen[5], Krystyna M. Saunders[5], Atun Zawadzki[5]

[1] School of Geography, The University of Melbourne, Melbourne, VIC, Australia.
[2] Centro de Investigação Marinha e Ambiental (CIMA), University of the Algarve, Faro, Portugal.
[3] Ernst-Moritz-Arndt-University Greifswald Institute for Geography and Geology, Greifswald, Germany.
[4] Department of Botany, Faculty of Science, Charles University, Prague, Czech Republic.
[5] Nuclear Science & Technology and Landmark Infrastructure (NSTLI), ANSTO, Lucas Heights, NSW, Australia.

Climate change, bushfires and human activities threaten a variety of ecosystems worldwide. For instance, Tasmanian rainforests and moorlands are in danger of severe reduction and extinction due to the impending environmental impacts brought by climate change.

To achieve sustainable landscape management and conservation plans, a quantitative assessment of past landscape alterations is pivotal. Before we can determine how appropriate it is to develop management plans that seek to restore naturalness or protect cultural heritage, we need to recognize the degree of past landscape alteration.

Landscapes that are characterised by a mixture of pristine vegetation and managed lands are challenging for conservationists

Figure 1: Preparation of the coring platform at the iconic Dove Lake, Western Tasmania, Australia (December 2015). Photo credit: Michela Mariani.

...it is evident that the landscape of Western Tasmania has been persistently treeless for the last 12,000 years, supporting the notion that this region represents an ancient cultural landscape.

because of the need to preserve both natural values and cultural heritage.

One tool that we can use to reconstruct past landscapes is the fossil pollen stored in sediments deposited in lakes. Although fossil pollen is the key proxy to track past changes in terrestrial environments, pollen spectra suffer some important biases (e.g. taphonomy, pollen productivity, dispersal capabilities). Often pollen records are dominated by a few high pollen-producing plant taxa, which may be masking the true vegetation cover.

The semi-quantitative nature of Australian palynology has allowed objective inferences of landscape change from pollen data, yet we remain uninformed about the actual degree of alteration of past land-cover due to these biases in pollen records. A case in point is the origin and evolution of the present-day dominance of pyrogenic moorland in Western Tasmania, which is the subject of a long-standing debate.

According to some authors, climate amelioration in Tasmania during the post-glacial turned most of the treeless landscape of the Last Glacial Maximum

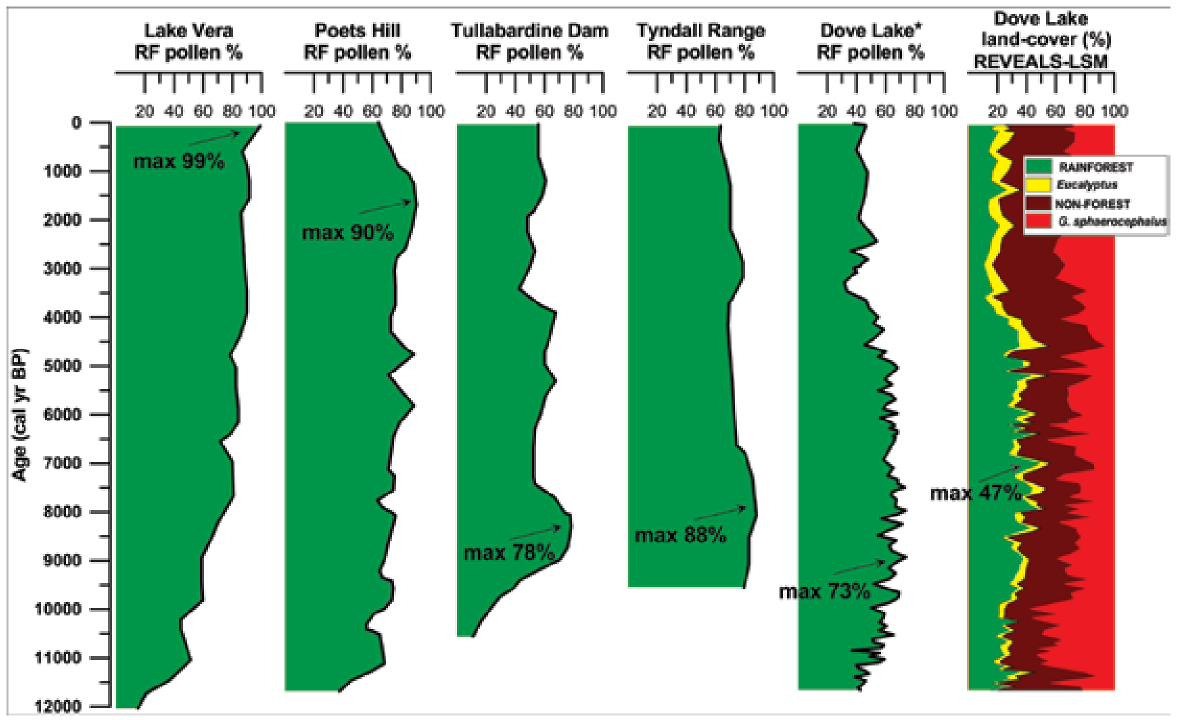


Figure 2: Summary diagram showing rainforest (RF) pollen abundance (as a percentage) from other Tasmanian pollen records compared to Dove Lake rainforest pollen percentage (asterisk) and land-cover estimates derived from the applications of pollen dispersal models performed in this PhD project. The buttongrass moorland cover percentage is represented in bright red (G. spherocephalus).

Figure 3: Surveying the buttongrass moorland around Dove Lake to calibrate pollen-vegetation relationships (February 2016). Photo credit: Petr Kuneš.

(ca. 18,000 years ago) into forest and woodlands. Others instead proposed that moorland became established across the region during the last glacial cycle (from ca. 35,000 years) and was then maintained by anthropogenic burning up to pre-colonial times, thus making the landscape of Tasmania an ancient cultural landscape.

Indeed, from the results of this approach, it is evident that the landscape of Western Tasmania has been persistently treeless for the last 12,000 years, supporting the notion that this region represents an ancient cultural landscape. This finding has important implications in enforcing conservation strategies for the threatened Tasmanian buttongrass moorland (Figure 3).

The linkages found between climatic change, fire history and vegetation have major implications in the development of suitable fire management and ecosystem conservation strategies, which are a key priority of present-day societies facing the imminent consequences of global warming and fire activity intensification.

Research was supported by Australian Research Council grants DI110100019 and IN140100050 and an AINSE AWARD (ALNGRA16024). Michela Mariani was also supported by an AINSE PGRA scholarship (#12039) and the John and Allan Gilmour Science Award (Faculty of Science, University of Melbourne). We acknowledge that our work was conducted on Tasmanian Aboriginal lands and thank the Tasmanian Aboriginal community for their support. We thank Michael Comfort from the Department of Primary Industries, Parks, Water & Environment (DPIPWE) for granting the permit to core Dove Lake. Thanks to Felicitas Hopf for providing surface sample pollen data for Lake St. Clair, and to Kristen Beck, Valentina Vanghi, Anthony Romano and Coralie Tate for assistance in the field.

Archaeology, Geosciences and Environmental Sciences AGES

Uptake and assimilation of cadmium, manganese and zinc by clams, prawns and fish

Kaitlyn O'Mara[1], Michele Burford[1], Jon Olley[1], Brian Fry[1], Tom Cresswell[2]

[1] Australian Rivers Institute, Griffith University, Nathan, QLD, Australia.
[2] Nuclear Science & Technology and Landmark Infrastructure (NSTLI), ANSTO, Lucas Heights, NSW, Australia.

Over 80% of Australia's population live within 50km of the coast. With cities densely aggregated around estuaries and coastal bays, these environments are often degraded by heavy metals and other contaminants.

Organism uptake and response to exposure to metals is highly varied, even between similar taxa, complicating our understanding of how organisms accumulate and respond to contamination. Our study aimed to identify primary sources for metal accumulation at different trophic levels and study their entry into, and transfer through, the estuarine food web.

Radiotracers, or radioisotopes, are an effective tool as their gamma-emitting properties allow us to follow the behaviour of particular metals over time in live organisms.

We collected wild sand clams *Katelysia scalarina*, school prawns *Metapenaeus macleayi* and sand whiting *Sillago ciliata*, which are commercially and recreationally important estuarine species. We exposed the live animals to several sources of cadmium (^{109}Cd), manganese (^{54}Mn) and zinc (^{65}Zn) in the ANSTO Aquatic Ecology lab, including dissolved in seawater, attached to suspended sediment particles, and as contaminated (radiolabelled) food.

While clams accumulated cadmium, manganese and zinc from seawater, the uptake by prawns was very low, especially for cadmium (Table 1). Fish did not take up any of the metals from seawater, even after water metal concentrations were increased to higher contamination levels. Unlike clams, uptake of metal from suspended sediment by prawns and fish was also negligible.

Clams are sensitive to metal uptake from a variety of sources and are identified here as an important link between contaminants in the environment and accumulation at higher trophic levels by predation.

We found diet to be the primary source

Figure 1: Dorsal view of a school prawn Metapenaeus macleayi.

Figure 2: A sand whiting Sillago ciliata in a radioanalysis container, held in a constant position for gamma counting by a semi-circular tube and sponge.

Source	Sand Clams	School Prawns	Sand Whiting
Seawater	✓	-	×
Suspended sediment	✓	-	×
Diet	✓	✓	✓

Table 1: Sources for accumulation of cadmium, manganese and zinc in clams, prawns and fish.

of ^{109}Cd, ^{54}Mn and ^{65}Zn accumulation in prawns and fish. The percentage of metal absorbed by an animal in a single feeding session is known as the *assimilation efficiency*. Interestingly, the assimilation efficiency of cadmium, manganese and zinc was much higher in school prawns (53-65%) compared to sand whiting (9-23%), suggesting that prawns would accumulate metals faster and at higher concentrations than fish.

The low assimilation efficiencies of sand whiting indicate that this species is somewhat tolerant to these metals. This is reflected in their occurrence throughout contaminated estuaries in NSW, such as Sydney Harbour. Clams are sensitive to metal uptake from a variety of sources and are identified here as an important link between contaminants in the environment and accumulation at higher trophic levels by predation.

This work was made possible by support from AINSE in the form of a Postgraduate Research Award (PGRA). It is a continuation of Dr. Tom Cresswell's (ANSTO) exploration into the use of radiotracers in aquatic ecology. The study was also supported by Merrin Adams (CSIRO Land and Water) and the ANSTO and Griffith University Animal Ethics Committees.

Figure 3: Sand clam Katelysia scalarina.

Understanding how antibiotics and gold nanoparticles affect bacterial membranes

Melanie A. Fuller[1], Jakob Andersson[1], Kathleen Wood[2], Stephen Holt[2], Ingo Köper[1]

[1] Institute for Nanoscale Science and Technology, Flinders University, SA, Australia.
[2] Nuclear Science & Technology and Landmark Infrastructure (NSTLI), ANSTO, Lucas Heights, NSW, Australia.

Multi-resistant bacterial infections are becoming more prevalent worldwide, with current estimations predicting 10 million deaths by 2050.

In an attempt to understand how different antibiotics affect the cell membrane, the antibiotic Colistin has been explored with a gram negative membrane model. Using tethered lipid bilayers, the interaction of Colistin with the membrane's surface can be explored by using Neutron Reflectometry. The effect of adding gold nanoparticles prior to exposing the membrane to Colistin is also being explored.

Our previous experiments found that Colistin disrupts the structure of the lipid membrane. This has been confirmed in Small Angle Neutron Scattering (SANS) experiments where Colistin was added to lipid vesicles.

Prior to the addition of Colistin, the vesicles were observed to have a unilamellar structure with no Bragg peaks present (as shown in Figure 1). However, after the addition of Colistin, a more ordered structure was observed.

The ordered structure was determined to be a multilamellar structure with Bragg peaks occurring at $q=0.064A^{-1}$ and $q=0.107A^{-1}$. The first peak also had a calculated d-spacing of $58A^{-1}$ and the secondary peak was attributed to a second order reflection. Thus the increased scattering intensity at low q, as well as the intensity plateau, suggests the addition of Colistin forms larger particles or vesicle aggregates (Andersson et al., 2018).

In our most recent work we have begun to explore the effects on the membrane structure of pre-treating gram-negative membranes with cationic gold nanoparticles prior to the addition of Colistin.

Initial results using Electrochemical

...the nanoparticles are likely causing small defects in the membrane that allow Colistin to solubilise the lipopolysaccharides at the defect site, causing irreversible damage to the membrane.

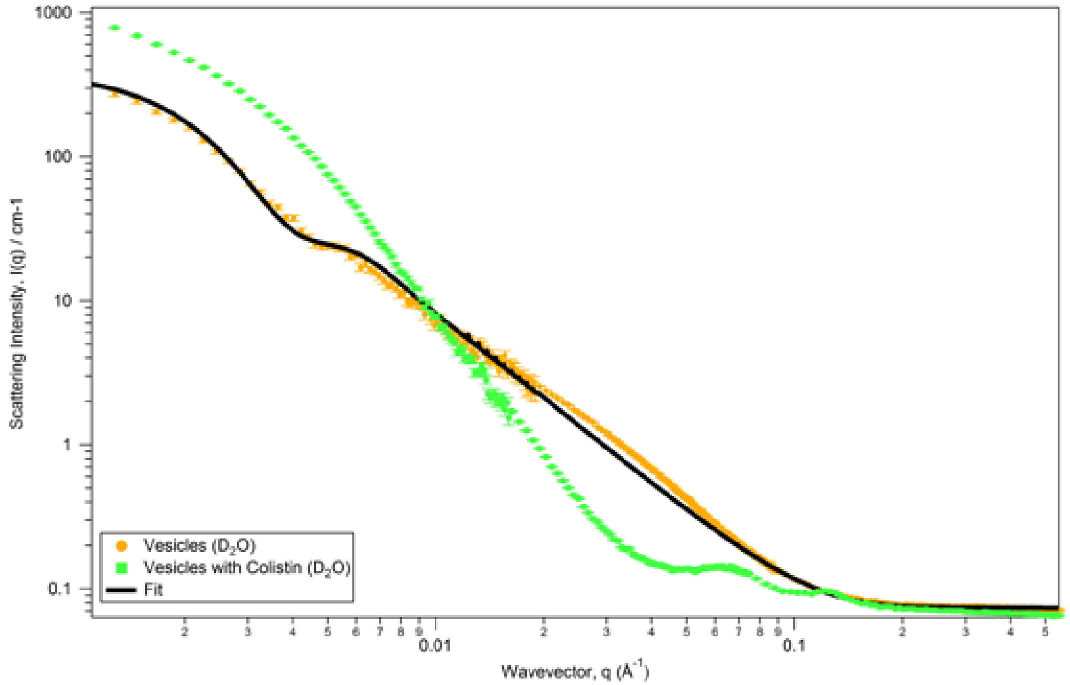


Figure 1: Small Angle Neutron Scattering plot of lipopolysaccharide vesicles obtained from Psudomonas aeruginosal prior to (orange) and after (green) the addition of 10 mg/mL Colistin.

Impedance Spectroscopy (EIS) have shown that the addition of cationic gold nanoparticles prior to the addition of Colistin reduces the membrane resistance and prevents an increase in capacitance. This suggests that the nanoparticles are likely causing small defects in the membrane that allow Colistin to solubilise the lipopolysaccharides at the defect site, causing irreversible damage to the membrane.

The next step in this research is to use neutron reflectometry with a tethered lipid bilayer to model which parts of the membrane the gold nanoparticles and Colistin are affecting (Figure 2).

This research will provide a better understanding on how the combination of the particles and antibiotic are disrupting the membrane, and may assist in the development of new antibiotics which target the bacterial membrane.

The authors acknowledge the Australian Institute of Nuclear Science and Engineering for the PGRA research funding.

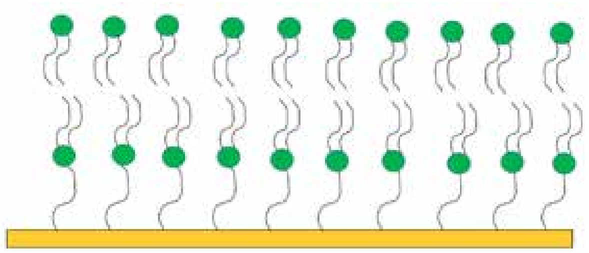


Figure 2: Tethered lipid bilayer on a gold substrate.

References:

Andersson, J, Fuller, M A, Wood, K, Holt, S A & Köper, I 2018, 'A tethered bilayer lipid membrane that mimics microbial membranes', *Physical Chemistry Chemical Physics*, vol. 20, no.18, pp. 12958–12969.

Interactions of polymyxins and octapeptins with model Gram-negative bacterial membranes

Mei-Ling Han[1], Tony Velkov[1], Kade D. Roberts[1], Anton P. Le Brun[3], Seong H. Chow[2], Matthew A. Cooper[4], Hsin-Hui Shen[5], Jian Li[2]

[1] Monash Institute of Pharmaceutical Sciences, Monash University, Parkville, VIC, Australia.
[2] Monash Biomedicine Discovery Institute, Monash University, Clayton, VIC, Australia.
[3] Nuclear Science & Technology and Landmark Infrastructure (NSTLI), ANSTO, Lucas Heights, NSW, Australia.
[4] Institute for Molecular Bioscience, The University of Queensland, Brisbane, QLD, Australia.
[5] Department of Materials Science and Engineering, Monash University, Clayton, VIC, Australia.

Polymyxins (i.e. polymyxin B and Colistin) are last-line antibiotics against life-threatening multidrug-resistant Gram-negative bacteria (Figure 1). Unfortunately, reports of polymyxin resistance are increasing, leading to a total lack of available therapies.

To date, the most common mechanism of polymyxin resistance is the modification of lipid A phosphate groups with positively charged 4-amino-4-deoxy-L-arabinose [L-Ara4N] moiety in the outer membrane of Gram-negative bacteria (Figure 2).

In order to overcome polymyxin resistance, polymyxin-like octapeptins—which do not exhibit cross-resistance with polymyxins and have a broader spectrum of activity—were rediscovered and investigated as potential candidates against polymyxin-resistant Gram-negative pathogens (Figure 1).

In the present study, an *in vitro* outer membrane model, consisting of

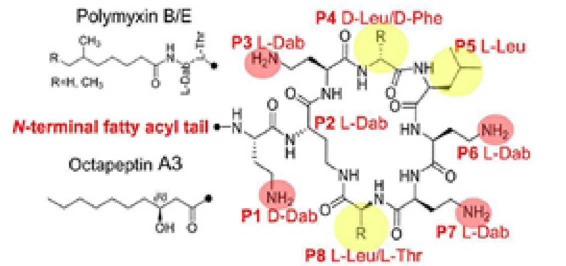


Figure 1: Chemical structures of polymyxin B and octapeptin A3. Leu: leucine; Phe: phenylalanine; Dab: α,γ-diaminobutyric acid. The hydrophobic side-chains are shaded yellow and the hydrophilic side-chains are shaded red (Velkov et al., 2013).

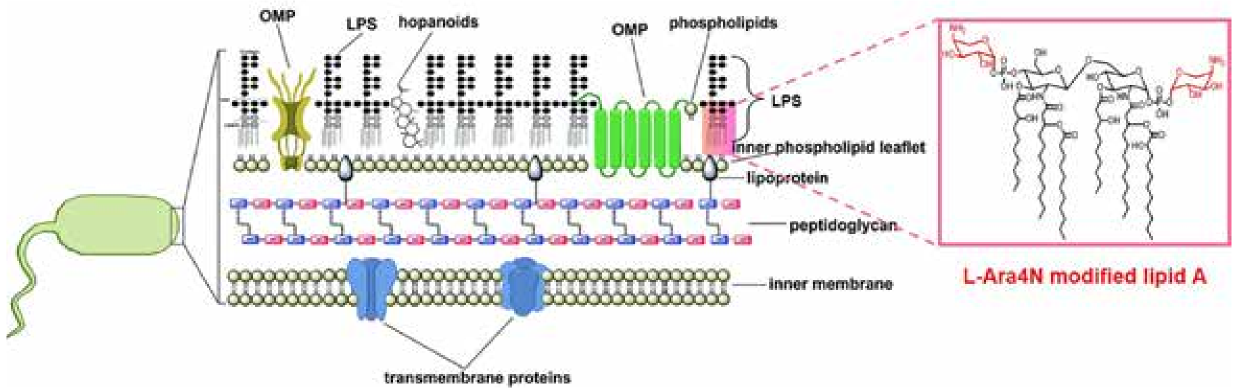


Figure 2: Architecture of the Gram-negative bacterial outer membrane (Olaitan, Morand and Rolain, 2014).

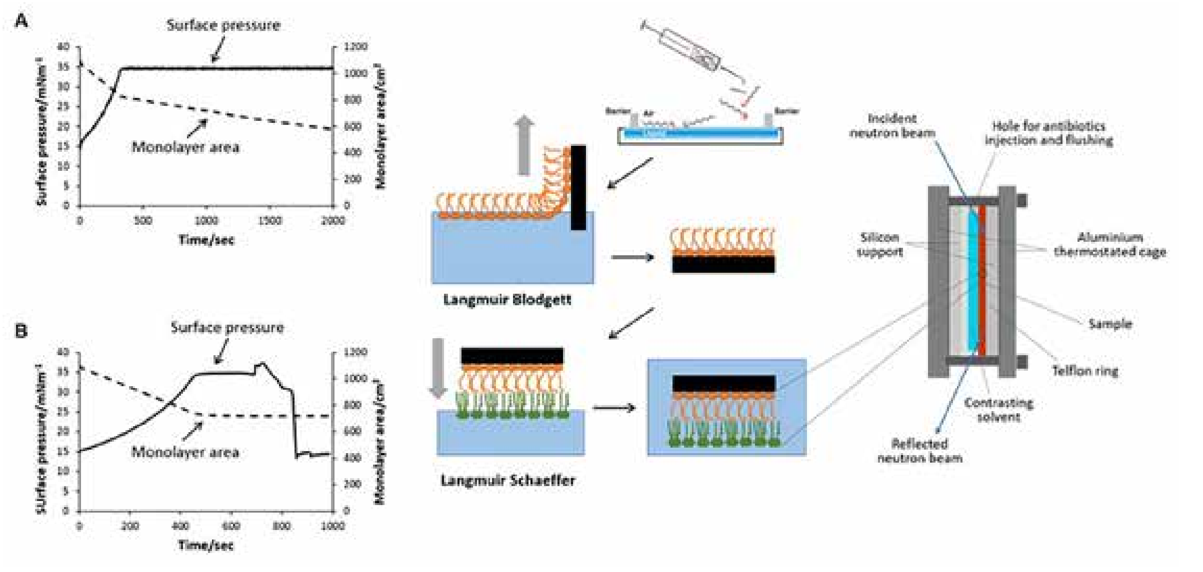


Figure 3: Bilayer formation and neutron reflectometry experimental set-up. Example time-course plots of surface pressure vs. monolayer area using (A) Langmuir-Blodgett and (B) Langmuir-Schaeffer deposition methods (Han et al., 2017).

...an important novel mechanistic insight into the development of new-generation lipopeptides.

unmodified/modified lipid A in the outer layer and 1,2-dipalmitoyl-d62-sn-glycero-3-phosphocholine (*d*-DPPC) in the inner layer, was constructed by sequential Langmuir-Blodgett and Langmuir-Schaefer deposition methods (Figure 3). The interactions with polymyxin B and Octapeptin A3 were investigated through neutron reflectometry.

Our results indicated a combination of both electrostatic (15.8%) and hydrophobic (6.1%) interactions between polymyxin B and the wild-type lipid A layer, and a further hydrophobic (9.3%) interaction with the *d*-DPPC layer in the model of wild-type lipid A: *d*-DPPC bilayer (Figure 4A).

In contrast, polymyxin B (21.7%) only bound to the surface of L-Ara4N modified lipid A without penetrating into the outer membrane bilayer, suggesting that the positively charged L-Ara4N moiety repels the polar interaction with polymyxin B and therefore confers polymyxin resistance (Figure 4B). Interestingly, the polymyxin-like lipopeptide octapeptin A3 displayed significantly superior hydrophobic interactions with the L-Ara4N modified lipid A, as demonstrated by the volume fractions of 17.3% and 25.8% octapeptin A3 found in the tail regions of lipid A and *d*-DPPC, respectively (Figure 4C).

Our neutron reflectometry results have revealed, for the first time, that the interaction of octapeptin A3 with the Gram-negative outer membrane involves an initial transient polar interaction with the lipid A headgroups, followed by the hydrophobic interactions with both lipid A and phospholipids in the outer membrane. This mechanism contrasts with that of polymyxin B, which specifically targets lipid A, whereas octapeptins appear to target both lipid A and phospholipids.

Overall, we are the first to employ cutting-edge neutron reflectometry to elucidate the complex interaction of polymyxin B and octapeptin A3 with model bacterial outer membranes, which provides a

powerful tool in understanding polymyxin mode of action and resistance, and an important novel mechanistic insight into the development of new-generation lipopeptides.

We would like to acknowledge ANSTO for awarding the neutron beam time (P4787 and 5344) and AINSE for the Postgraduate Research Award. This research was also supported by a research grant from the National Institute of Allergy and Infectious Diseases of the National Institutes of Health (R01 AI111965).

References:

Velkov, T, Roberts, K D, Nation, R L, Thompson, P E & Li, J 2013, 'Pharmacology of polymyxins: new insights into an 'old' class of antibiotics', *Future Microbiology*, vol. 8, pp. 711–724.

Olaitan, A O, Morand, S & Rolain, J-M 2014, 'Mechanisms of polymyxin resistance: acquired and intrinsic resistance in bacteria', *Frontiers in Microbiology*, vol. 5, p. 643.

Velkov, T, Roberts, K D & Li, J 2017, 'Rediscovering the octapeptins', *Natural Product Reports*, vol. 34, pp. 295–309.

Han, M L, Shen, H H, Hansford, K A, Schneider, E K, Sivanesan, S, Roberts, K D, Thompson, P E, Le Brun, A P , Zhu, Y, Sani, M A & Separovic, F 2017, 'Investigating the interaction of octapeptin A3 with model bacterial membranes', *ACS Infectious Diseases*, vol. 3, pp. 606–619.

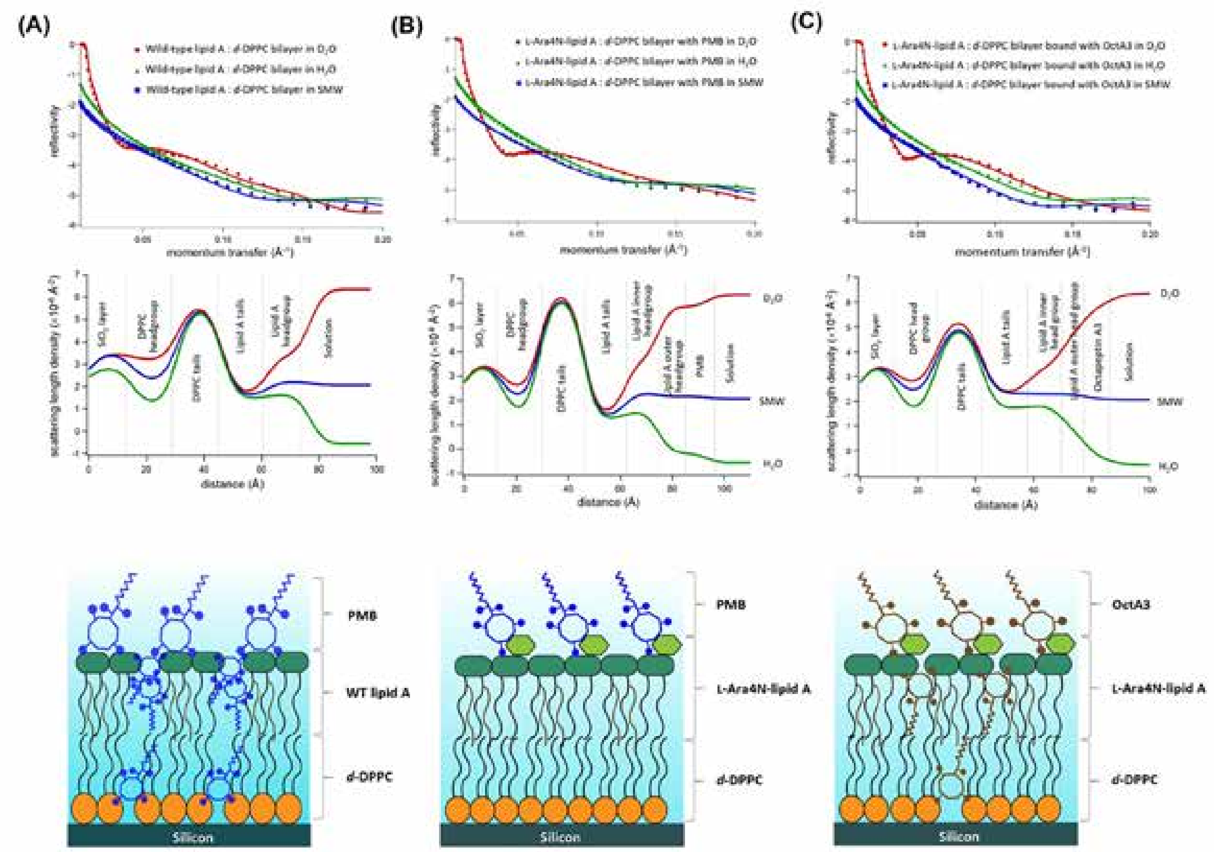


Figure 4: Interactions of polymyxin B (PMB) and octapeptin A3 (OctA3) with wild-type and L Ara4N modified lipid A. NR profiles (upper), fitted SLDs and thicknesses (middle) in different solution isotopic (D2O, SMW and H2O) contrasts, and schematic representations (lower) of the interfacial structures of OM bilayer models interacted with PMB and OctA3: (A) wild-type lipid A-PMB, (B) L-Ara4N-lipid A-PMB, and (C) L-Ara4N-lipid A-OctA3. SMW: silicon matched water, which contains 38% D2O and 62% H2O. (Olaitan, Morand and Rolain., 2014).

Unlocking the potential of rhenium for improved nuclear medicines

Mitchell Klenner[1,2], Giancarlo Pascali[1], Max Massi[2], Benjamin Fraser[1]

[1] Human Health (HH), ANSTO, Lucas Heights, NSW, Australia.

[2] Department of Chemistry, Curtin University, Bentley, WA, Australia.

Radiotracers are commonly used to investigate biochemical systems in living organisms and are routinely employed as nuclear medicines to diagnose cancers and other disease pathologies.

To synthesise nuclear medicines, a drug or biomolecule needs to be radiolabelled with a radioisotope. The radioisotope then emits detectable radiation from the site of the tumour or organ where the radiotracer has accumulated.

However, many disease states remain untreated by nuclear medicines—not necessarily because new molecules are needed to target these diseases, but also because of the immense difficulty required to radiolabel these molecules.

This opens new avenues for developing Alzheimer's PET medicines that can now be investigated.

The radiolabelling process needs to be performed as time-efficiently as possible, since radioactive decay during the time of synthesis will result in less radioactivity being available for imaging following administration of the radiotracer to the patient. Thus the discovery of new radiolabelling methods is critical: not only for the improved synthesis of currently-existing nuclear medicines but also to enable the synthesis of new radiotracers that could eventually become the nuclear medicines needed to diagnose untreated disease states.

Herein we describe a novel radiolabelling method used to improve the molecular incorporation of fluorine-18 (Klenner et al., 2017a), the most commonly-employed radioisotope used in the most sensitive of nuclear imaging techniques, positron emission tomography (PET) imaging. We tested this method repeatedly using an automated synthesis module, as shown in Figure 1, which enabled us to repeat reactions under the same conditions while changing only the temperature as a variable, thus revealing temperature-dependent trends within our method.

The method involves first and foremost the complexation of a bidentate molecule to a source of rhenium(I), in our case using pentacarbonylchlororhenium(I) chloride (Klenner et al., 2017b), which activates the bidentate molecule via electron withdrawal as suggested by our nuclear magnetic resonance (NMR) spectrometry data. Fluorine-18 radiolabelling of the rhenium complex then results with high radiochemical yield (RCY) up to 130°C, as shown by the orange chromatogram in Figure 2. At higher temperatures, the radiolabelled complex then dissociates in order to liberate the radiolabelled ligand in considerable RCY, as evidenced by the cyan line of Figure 2.

Perhaps the most impressive aspect of this method is that the radiolabelled ligand, [^{18}F]6-fluoro-2,2'-bipyridine, was unable to be synthesised under any of our radiolabelling conditions until complexed with the source of rhenium. Figure 3 shows the overall trend of forming the fluorine-18 labelled complex in greater RCY as temperature increases, as shown by the red line (pink crosses), until it eventually dissociates at temperatures greater than 130°C to free the radiolabelled ligand of interest, as shown by the blue line (cyan crosses).

Following this discovery, we pursued a systematic investigation to determine the limitations of radiofluorination and discovered that we could use this method to substitute our fluorine-18 radioisotope for different atoms, as shown in Figure

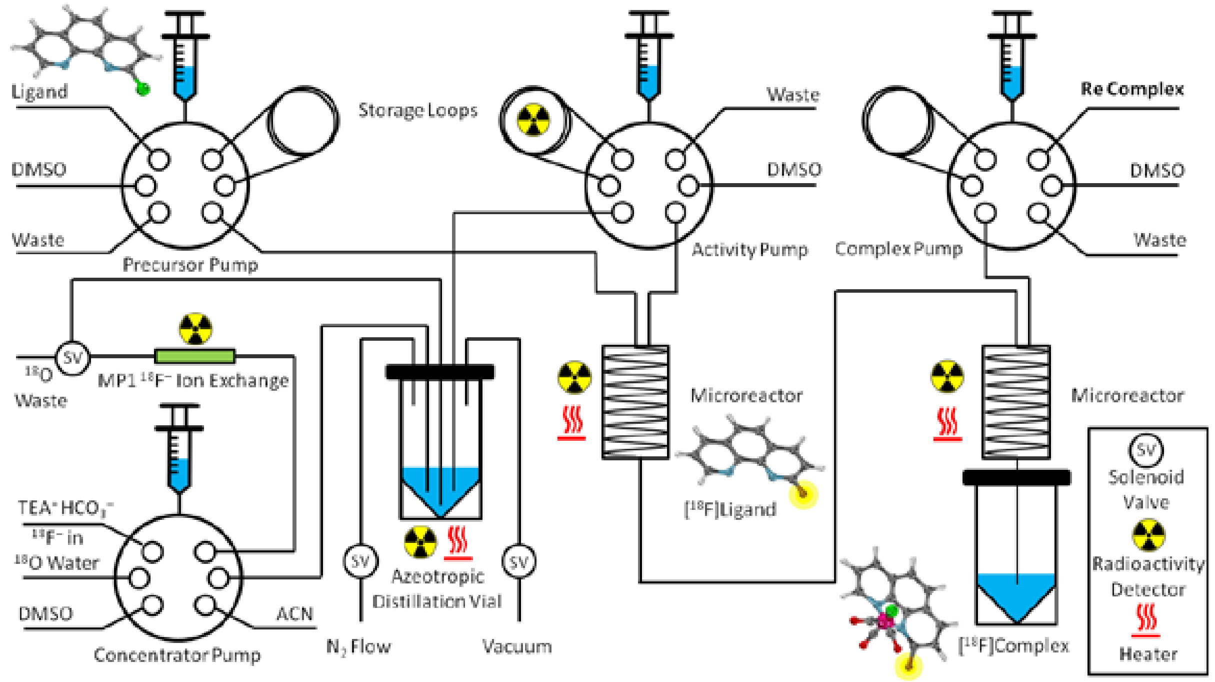


Figure 1: Automated synthesis module constructed from microfluidic technology for this project.

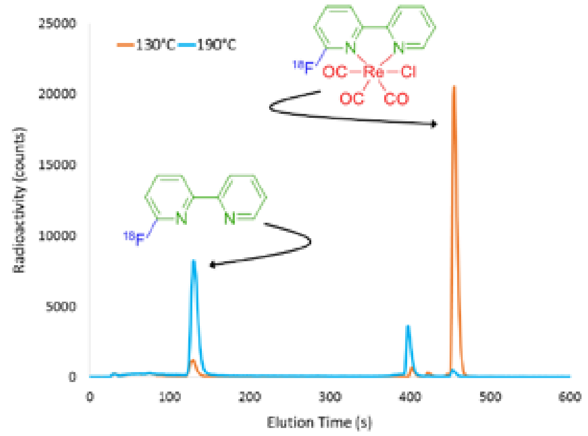


Figure 2: RadioHPLC trace showing the formation of the radiolabelled rhenium complex (orange line) at 130°C, followed by high temperature decomplexation to form the radiolabelled ligand (cyan line) which was formally unable to be synthesised.

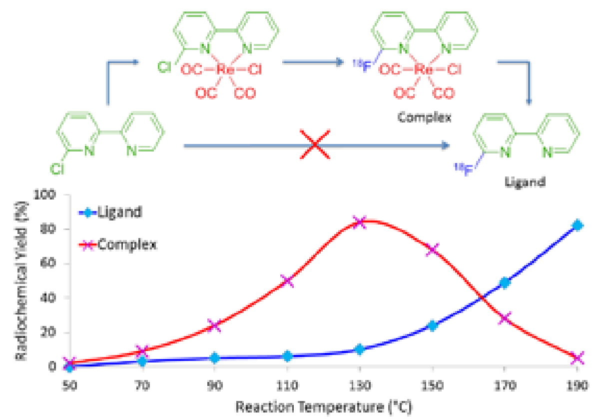


Figure 3: Radiosynthesising the fluorine-18 labelled rhenium complex (red line), which dissociates under higher temperatures to liberate the fluorine-18 labelled ligand (blue), thus producing a radiotracer which could not be synthesised hitherto.

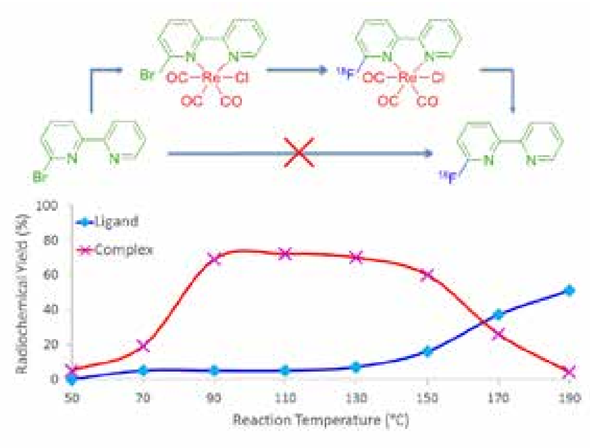


Figure 4: The rhenium-dissociation strategy applies for alternative leaving groups for [^{18}F]Fluoride substitution, in this case the displacement of a bromine atom instead of a chlorine atom.

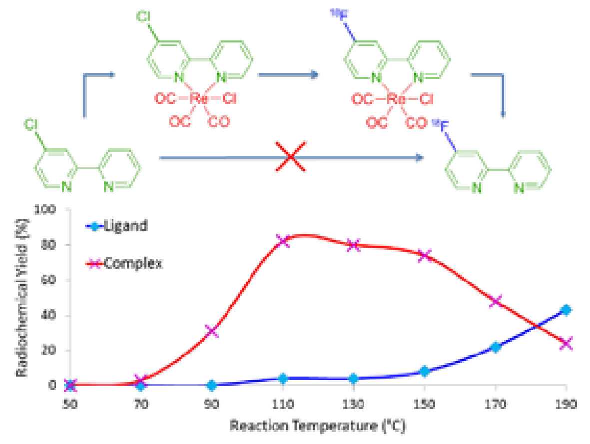


Figure 5: The rhenium-dissociation strategy also applies to other positions of the molecule, in this case the substitution of a chlorine atom for fluorine-18 in the para position of the molecule rather than the ortho position.

4 (substituting for bromine instead of chlorine), and could radiolabel in different positions of the molecule, as shown in Figure 5.

Based on these observations we attempted to apply this novel rhenium complexation-dissociation strategy for the improved synthesis of [^{18}F]CABS13, a PET medicine used in the imaging and disaggregation of amyloid-β plaques characteristic of Alzheimer's disease (Vasdev et al. 2012, Liang et al. 2015a). Preliminary experiments have returned 18% RCY of the rhenium complex and 5% RCY of the [^{18}F]CABS13 ligand versus the 19±5% RCY attained though multistep radiosynthetic processes in literature, as shown in Figure 6.

Excitingly, this method was able to synthesise the medicinal compound [^{18}F]5-fluoro-8-hydroxyquinoline, which is an alternative to [^{18}F]CABS13 that has been shown to disaggregate amyloid-β plaques more effectively in cell experiments, though remained unable to be radiosynthesised until now (Liang et al. 2015b). This opens new avenues for developing Alzheimer's PET medicines that can now be investigated.

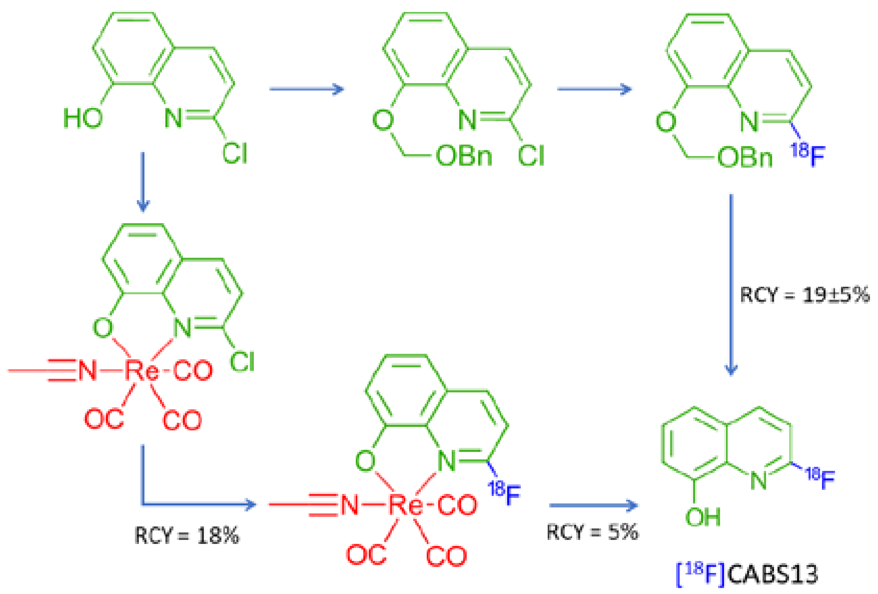


Figure 6: Comparison of the traditional (top) and rhenium-applied (bottom) radiosynthetic approaches to producing the [^{18}F]CABS13 Alzheimer's disease imaging agent.

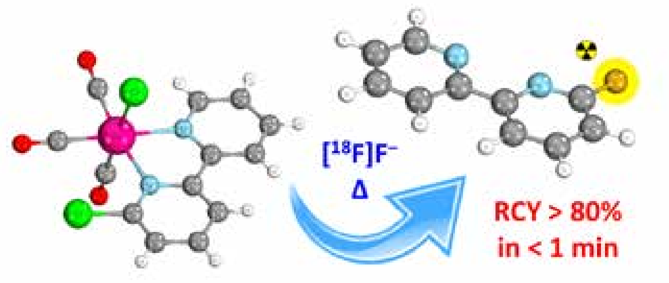


Figure 7:Crystal structure of one of the rhenium complexes (obtained from the Australian Synchrotron), which enables the formation of radiotracers previously unobtainable in high RCY and extremely time-efficient syntheses. Single crystal data was collected at MX1 on the Australian Synchrotron via Collaborative Access Program 12368, PI Jack Clegg (UQ).

The discovery of this novel rhenium complexation-dissociation approach is incredibly exciting news which could not have made possible without the hard work, expertise and collaboration of others. Foremost is the intellectual support and supervision provided from Dr. Giancarlo Pascali, Dr. Max Massi and Dr. Benjamin Fraser. The appreciation is extended also to Dr. Helen Maynard-Casely and Jack Clegg, for their collaboration at the Australian Synchrotron (refer to crystal structure in Figure 7), as well as Bo Zhang and Dr. James Howard for their aid in the radioactive and non-radioactive syntheses respectively. Finally, we also express our immense gratitude to AINSE, not only for the generous funding which bought about the success of this project, but also for their compassionate and encouraging support along the way.

References:

Klenner, M A, Pascali, G, Zhang, B, Sia, T R, Spare, L K, Krause-Heuer, A M, K.L. Aldrich-Wright, J, Greguric, I, Guastella, A, Massi, M & Fraser, B H 2017a, 'A fluorine-18 radiolabeling method enabled by Rhenium(I) complexation circumvents the requirement of anhydrous conditions', *Chemistry: A European Journal*, vol. 23, pp. 6499–6503.

Klenner, M A, Pascali, G, Zhang, B, Sia, T R, Spare, K L Aldrich-Wright, J, Greguric, I, Guastella, A, Massi, M & Fraser, B H 2017b, 'Effect of Re(I) complexation in the radiosynthesis of prospective [^{18}F] fluorine labelled PET/optical probes', *Journal of Labelled Compounds and Radiopharmaceuticals*, vol. 60, p.S65.

Vasdev, N, Cao, P, Van Oosten, E M, Wilson, A A , Houle, S, Hao, G, Sun, X, Slavine, N, Alhasen, M, Antich, P P, Bonte, F J & Kulkarni, P 2012, 'Synthesis and PET imaging studies of [^{18}F]2-Fluoroquinolin-8-ol ([^{18}F]CABS13) in transgenic mouse models of Alzheimer's disease', *MedChemComm*, vol. (3), pp. 1228–1230.

Liang, S H, Holland, J P, Stephenson, N A, Kassenbrock, A, Rotstein, B H , Daignault, C P, Lewis, R, Collier, L, Hooker, J M & Vasdev, N 2015a, 'PET neuroimaging studies of [^{18}F]CABS13 in a double transgenic mouse model of Alzheimer's disease and nonhuman primates', *ACS Chemical Neuroscience*, vol. 6, pp. 535–541.

Liang, S H, Southon, A G, Fraser, B H, Krause-Heuer, A M, Zhang, B, Shoup, T M, Lewis, R, Volitakis, I, Han, Y, Greguric, I, Bush, A I & Vasdev, N 2015b, 'Novel fluorinated 8-hydroxyquinoline based metal ionophores for exploring the Metal Hypothesis of Alzheimer's disease." *ACS Medicinal Chemistry Letters*, vol. 6, pp. 1025–1029.

Improving discovery and production of fluorine-18 radiopharmaceuticals

Bo Zhang[1,2], Giancarlo Pascali[1], Naomi Wyatt[1], Lidia Matesic[1], Andrea Robinson[2], Benjamin Fraser[1,2]

[1] Human Health (HH), ANSTO, Lucas Heights, NSW, Australia.

[2] School of Chemistry, Monash University, Clayton, VIC, Australia.

Fluorine-18 radiopharmaceuticals are critical in the diagnosis and treatment of numerous diseases including breast cancer, melanoma and Alzheimer's disease. The ongoing discovery of new radiopharmaceuticals and improvement of methods for producing them are therefore of the utmost importance.

Currently many drug-like vectors, including small molecules and proteins which have significant potential as life-saving radiopharmaceuticals, never reach human clinical trials because they cannot be radiolabelled efficiently. In addressing this problem, we discovered [18F]ethenesulfonyl fluoride (ESF) and developed it into an innovative tool for fluorine 18 radiolabelling and radiopharmaceutical production.

...an innovative tool for fluorine-18 radiolabelling and radiopharmaceutical production.

The non-radioactive version of ESF reacts very readily, at low temperatures, with functional groups present on biological molecules. This unusual and unique chemical property made a fluorine-18 version of ESF a natural candidate for investigation regarding its potential as a reagent for labelling biological vectors and making new radiopharmaceuticals.

The radiosynthesis of $[^{18}F]$ESF was developed employing both carrier-added (c.a.) and no-carrier-added (n.c.a.) approaches, with excellent radiochemical yields (RCYs) and radiochemical purities (RPs) of >95%. All radiolabelling reactions were carried out on a Advion NanoTek microfluidic reactor, allowing for reaction optimisations that would otherwise take months to be completed in just a few days (Figure 1).

The subsequent conjugation reactions of $[^{18}F]$ESF were tested on 9 amino acids and 2 proteins in various solvents using a "shake & bake" approach. A RCY of >35% was observed using aqueous/organic solvent mixtures.

Stability tests were then conducted on all the purified conjugates in injectable formulations over a two-hour time frame (Figure 2). In this case, we found that after two hours $[^{18}F]$Ani-ESF was the most stable candidate with 92% RP, followed by $[^{18}F]$Cys-ESF with 43%. BSA and Insulin conjugates were both 54% pure after two hours. Stability in rat serum for the protein conjugates was not as promising, with the Insulin conjugate reaching 13% RP after 15 min while the BSA conjugate completely degraded within the same timeframe.

Although these results suggest $[^{18}F]$ESF is not suitable as a new reagent for radiolabelling biological vectors, we have further investigated a second application of $[^{18}F]$ESF as a "fluoride relay" reagent. The results from this work are forthcoming and promising. Current work is underway to translate $[^{18}F]$ESF as a fluoride relay reagent into select local hospitals, for investigation as a new method for simplifying production of research and clinical fluorine-18 radiopharmaceuticals.

The work described above was undertaken at ANSTO by Monash University PhD student Bo Zhang. Ben Fraser and Giancarlo Pascali are Bo's ANSTO co-supervisors in the areas of chemistry and radiochemistry. Prof. Andrea Robinson is Bo's Monash University supervisor and an expert in peptide and protein synthesis. Naomi Wyatt and Lidia Matesic are ANSTO radiochemists who helped train Bo in radiochemistry and the design of radiotracer stability studies. Financial support from Monash University (MGS and MIPRS) and The Australian Institute of Nuclear Science and Engineering (AINSE PGRA 12074) is gratefully acknowledged.

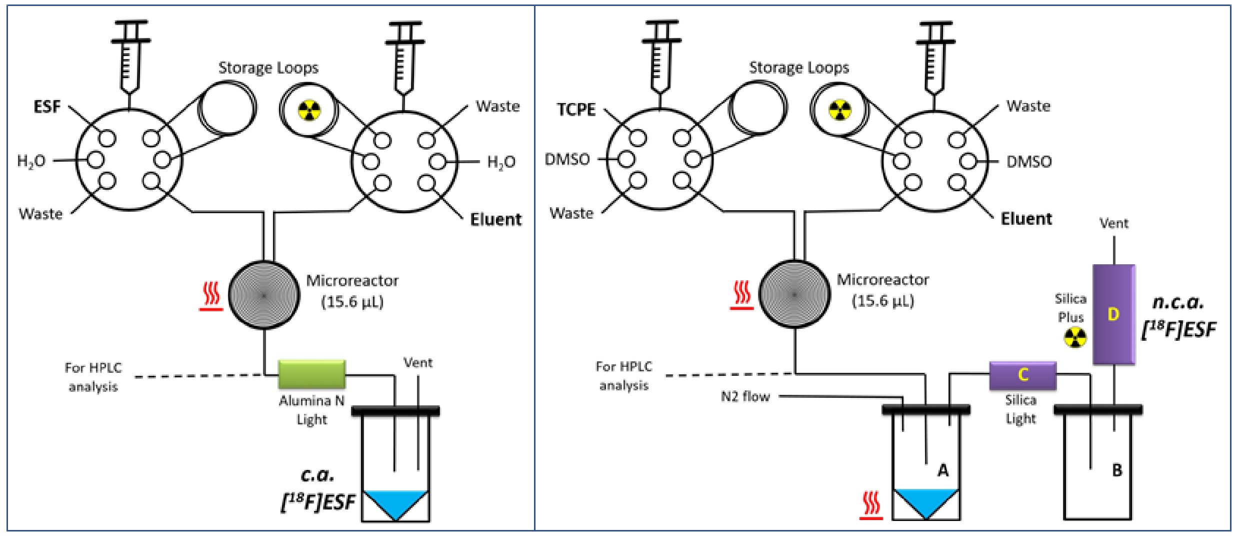


Figure 1: Microfluidic reaction system to optimise radiolabelling conditions for production of $[^{18}F]$ESF.

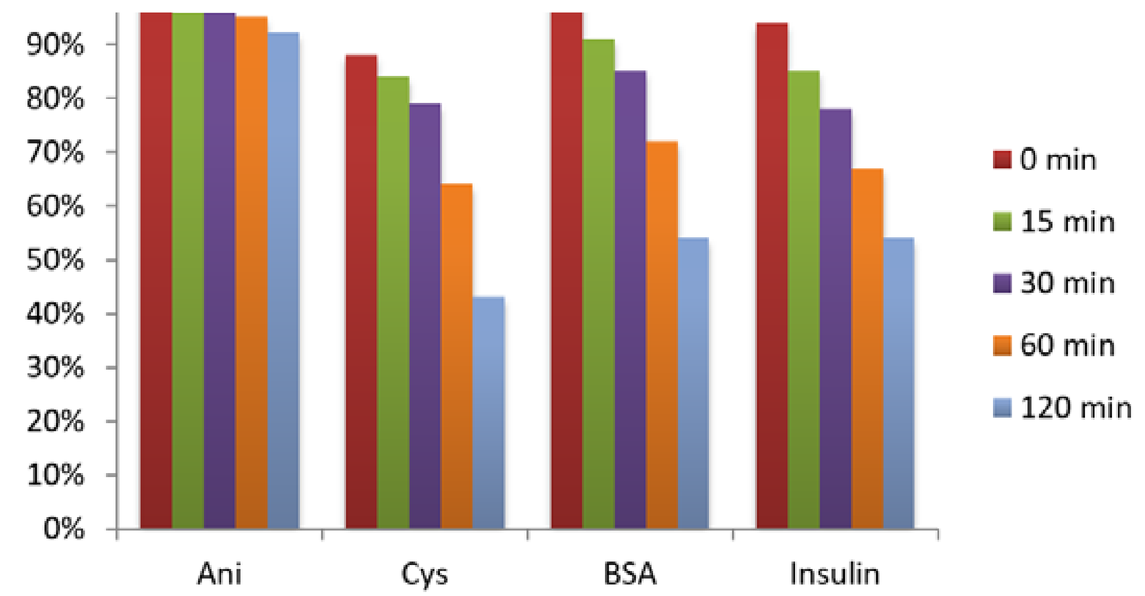


Figure 2: Stability results of selected n.c.a. $[^{18}F]$ESF adducts in injectable formulations.

Controlling atomically-thin carbon in water with detergents

Thomas M. McCoy[1], Liliana de Campo[2], Anna V. Sokolova[2], Stephen A. Holt[2], Rico F. Tabor[1]

[1] School of Chemistry, Monash University, Clayton, VIC, Australia.
[2] Australian Centre for Neutron Scattering (ACNS), ANSTO, Lucas Heights, NSW, Australia.

Since the discovery of the atomically-thin carbon material `graphene' over a decade ago, research into two-dimensional materials has surged with considerable efforts being devoted to discovering new 2D substrates and ways of utilising their unique properties.

Of particular interest is the water-dispersible analogue of graphene called graphene oxide (GO), a robust material that, while only a single nanometre thick, can range up to tens of microns in diameter (Figure 1). This gives the material an ultrathin sheet-like structure, and due to a high degree of oxygen functionality it can easily be dispersed in water. These properties make GO an extremely promising material for environmental applications such as water purification and oil recovery, where high surface area is a huge advantage.

The challenging aspect of working with these materials is controlling their behaviour when dispersed in water. The ability to do this would not only improve the effectiveness of the materials during application, but also allow them to be recovered once used, which is essential in environmental applications.

Our work aims to develop and understand methods by which graphene oxide can be controlled in aqueous solution using small molecule adsorbates called surfactants (or detergents). Depending on the chemistry of these compounds, the surfactant molecules can stick to the surfaces of the GO sheets and cause them to aggregate or redisperse, allowing for their capture and reuse (McCoy et al. 2018).

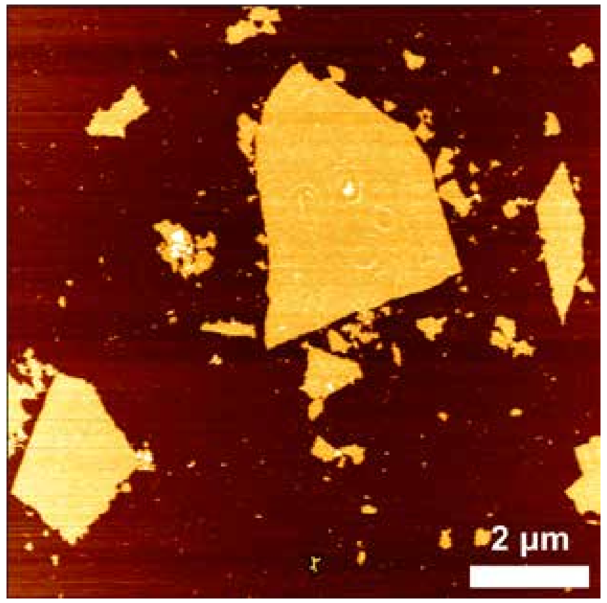


Figure 1: Atomic force microscopy image of graphene oxide (GO) sheets.

...these novel systems could also be used for enhanced oil recovery with stimulus responsive release capabilities.

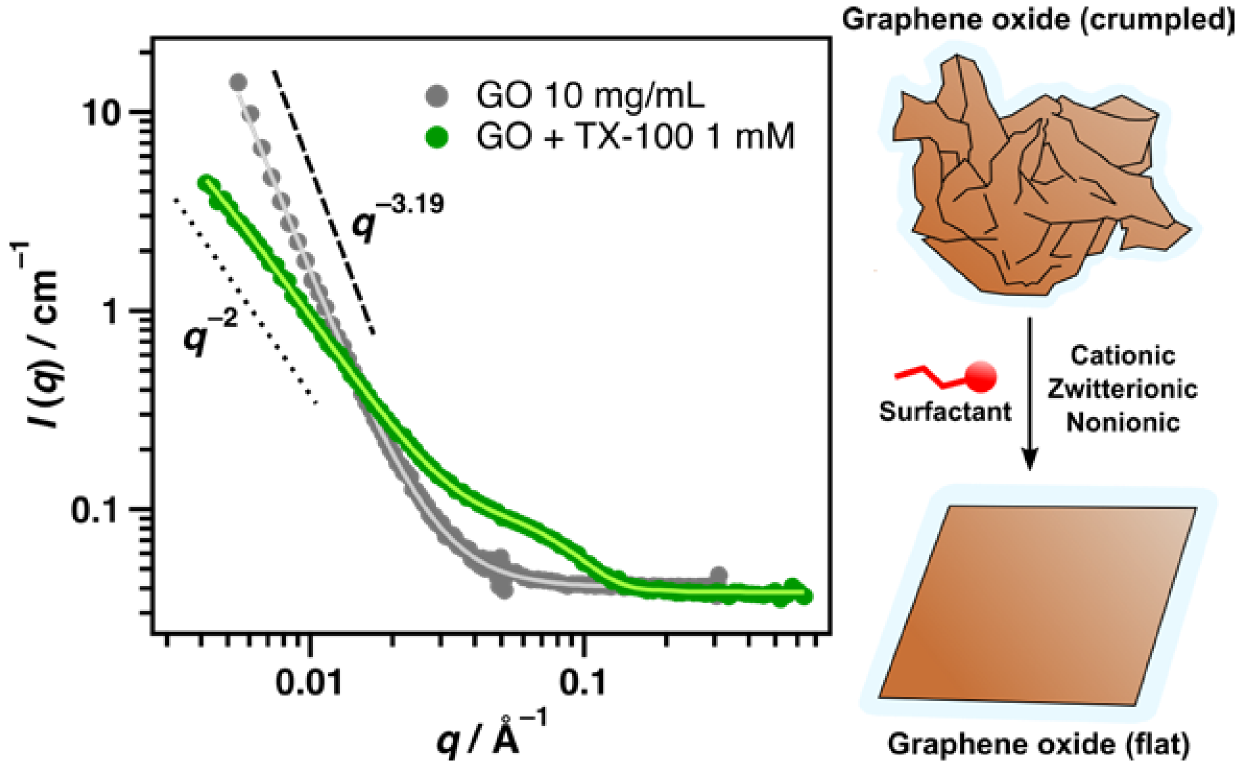


Figure 2: SANS data of pure graphene oxide (GO) in water and GO with TX-100 surfactant (solid lines are model fits); note the difference in slope at low q. The schematic depicts the `flattening' of the GO sheets when surfactants adsorb to the surface.(McCoy et al. 2018).

Interestingly, small-angle neutron scattering (SANS) experiments conducted at Lucas Heights have also indicated that the surfactants change the morphology of the GO sheets in solution from crumpled to flat, indicated by the change in slope of the scattering pattern at low scattering vector q (Figure 2) (McCoy et al. 2018). We have dubbed this phenomenon `nano-ironing', which could be useful in coating and nanotemplating applications.

In addition to affecting the dispersion stability of the GO sheets, surfactant adsorption on the sheets was also found to greatly increase their affinity for interfaces such as the air–water and oil–water interfaces.

X-ray reflectivity measurements performed at ANSTO suggest that the GO sheets and surfactant molecules act in synergy for enhanced adsorption at the interface (Figure 3a,c) (McCoy et al. 2017). The particular surfactant molecule used in this system was also sensitive to different wavelengths of light that significantly alter its surface, allowing this effect to be manipulated using light as a clean and low energy external stimulus (McCoy et al. 2017).

These results suggest that these novel systems could also be used for enhanced oil recovery with stimulus responsive release capabilities.

We would like to acknowledge support from the Australian Institute of Nuclear Science and Engineering, as well as the Monash Centre for Atomically Thin Materials for sponsoring this work. The outcomes of this work would not have been possible without the incredible support of ANSTO beamline scientists Liliana de Campo (SANS/USANS), Anna Sokolova

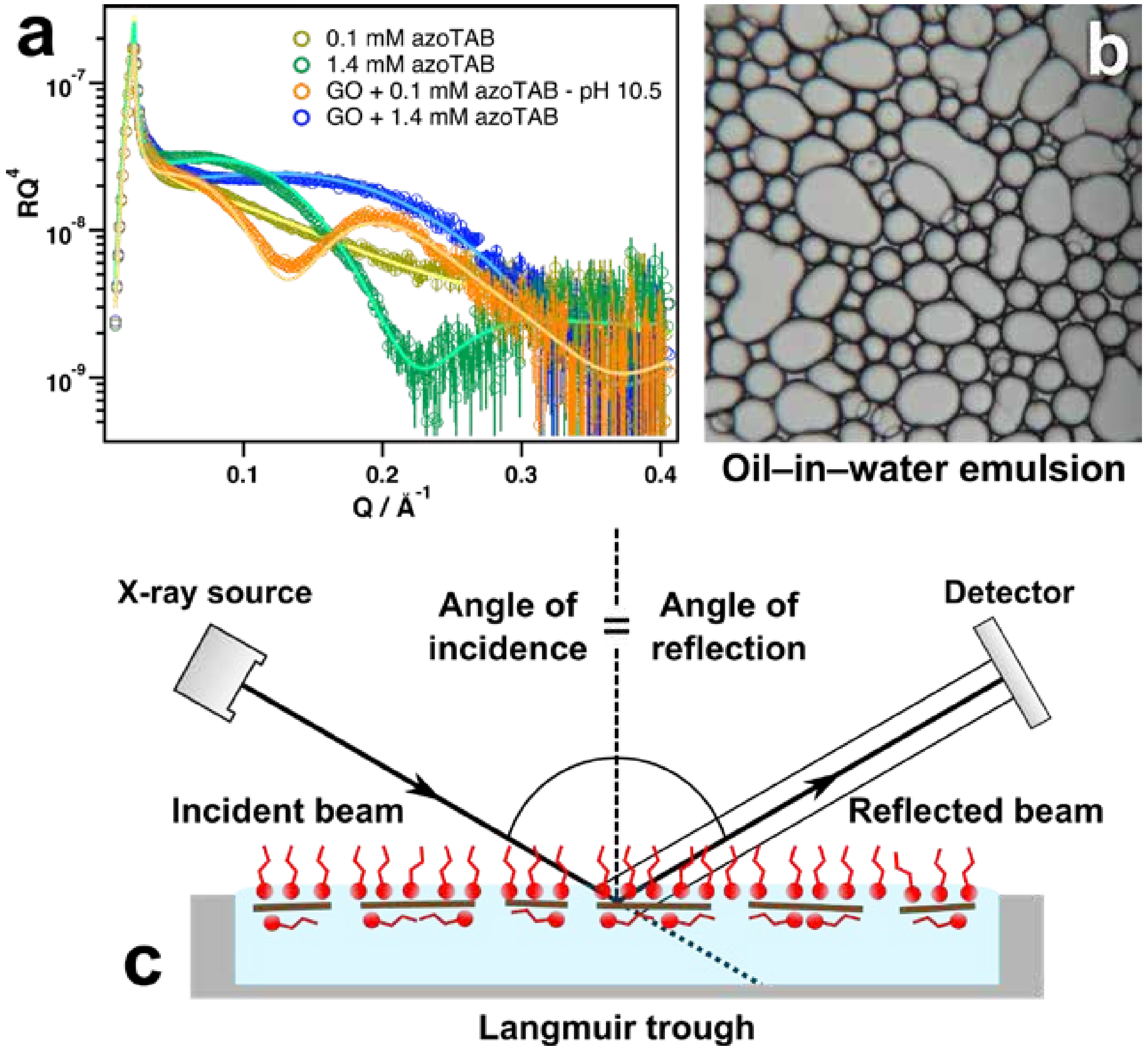


Figure 3: (a) X-ray reflectivity data of samples containing 0.1 mg mL^{-1} GO and/or trans azoTAB at the specified concentrations (solid lines are model fits). (b) Optical microscopy image of an oil–in–water emulsion stabilised by GO and azoTAB. (c) Schematic of X-ray scattering from GO/surfactant composites at the air–water interface (McCoy et al. 2017).

(SANS) and Stephen Holt (XRR). Their diligence and expertise ensured that the experiments were carried out meaningfully and successfully.

References:

McCoy, T M, de Campo, L, Sokolova, A V, Grillo, I, Izgorodina, E I & Tabor, R F 2018, 'Bulk properties of aqueous graphene oxide and reduced graphene oxide with surfactants and polymers: adsorption and stability', *Physical Chemistry Chemical Physics*, vol. 20), pp. 16801–16816.

McCoy, T M, Holt, S A, Rozario, A M, Bell, T D M & Tabor, R F 2017, 'Surfactant-enhanced adsorption of graphene oxide for improved emulsification of oil in water', *Advanced Materials Interfaces*, vol. 4, p. 1700803.

Zapping chemical bonds: Triggered rapture of alkoxyamine at room tempterature

Long Zhang[1], Nadim Darwish[2], Gordon G. Wallace[1], Michelle L. Coote[3], Simone Ciampi[2]

[1] ARC Centre for Excellence for Electromaterials Science, Intelligent Polymer Research Institute, University of Wollongong, Wollongong, NSW, Australia.

[2] Department of Chemistry, Curtin University, Bentley, WA, Australia

[3] ARC Centre of Excellence for Electromaterials Science, Research School of Chemistry, Australian National University, Canberra, ACT, Australia.

Alkoxyamines are heat-labile precursors widely used as a source of nitroxides in polymer and materials sciences, but traditionally require high temperatures (80–120°C) for this purpose.

Our team has shown that electrostatic forces can accelerate the carbon-oxygen bond (C–O) cleavage—the first evidence that an electric trigger can guide alkoxyamine lysis at room temperature. Producing a controllable source of nitroxides at lower temperatures will greatly increase their scope in chemical synthesis.

This work provides a breakthrough use of external electric fields in organic synthesis: to cleave alkoxyamines within the Debye layer of an electrified interface or to generate surface-tethered persistent radicals under anodic conditions in a switchable manner (Figure 1) (Zhang et al. 2018a).

This catalytic effect, while validating theoretical frameworks, was not quantitatively sufficient to explain the lysis. Therefore, this work has been expanded to include an independent experimental demonstration of pure electrostatic cleavage of the neutral alkoxyamine molecule. This was achieved using single molecule break junction experiments in a scanning tunneling microscopy (STM-BJ technique), defining the magnitude of this catalytic effect by looking at an independent electrical signal (Figure 2) (Zhang et al. 2018a).

From a practical perspective, these results offer a basis for controlling polymer growth on electrified interfaces and possibly a new way of studying the energy of ionic aggregates within electric double layers by measuring their effects on equilibrium positions and rates of non-redox reactions.

...these results offer a basis for controlling polymer growth on electrified interfaces...

Developing new and more efficient ways to control chemical reactivity and selectivity has been a constant priority throughout the history of chemistry. The impact of static electricity on non-redox reactivity, long theorised by chemists, is now beginning to emerge as an important branch of chemical catalysis. Establishing

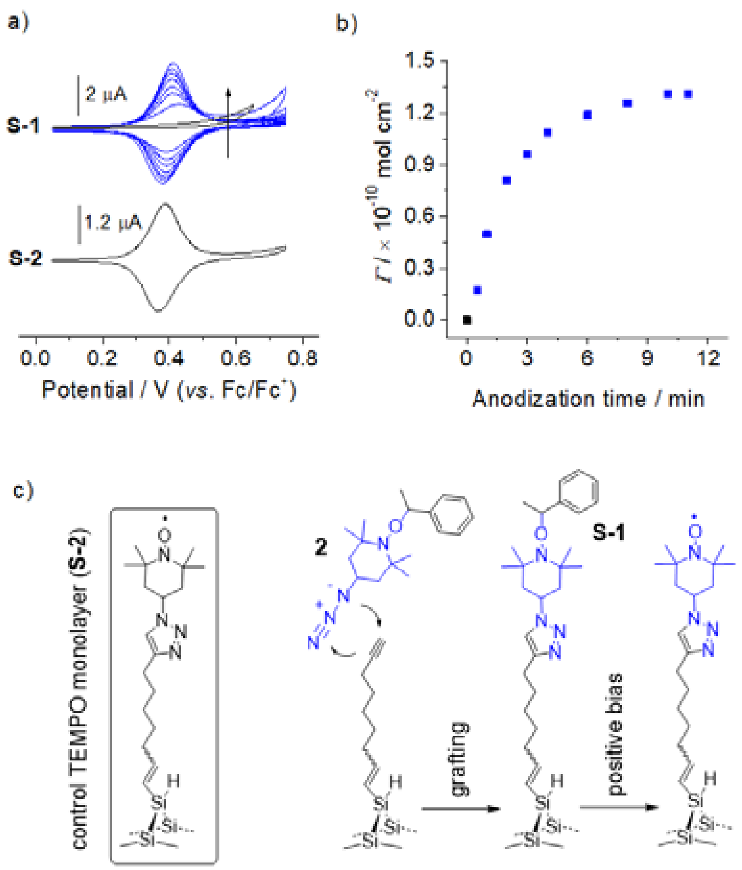


Figure 1: Anodic cleavage of a surface-tethered alkoxyamine (S-1) and its conversion into a Si(100) nitroxide-terminated monolayer (electrolyte is 1.0×10^{-1} M Bu4NClO4 in MeCN). The monolayer distal-end of S-1 samples is the phenylethyl portion of an alkoxyamine molecule (1) and it is lost to the electrolyte upon electrolysis. (a) Cyclic voltammograms (100 mV s^{-1}) acquired before (black trace) and after (blue trace) applying a positive bias to S-1 samples prepared on Si(100) electrodes. The potential is stepped from open circuit to 0.65 V (vs. Fc/Fc+) for a 30s period before recording a voltammogram and selected traces are presented in the figure (blue traces). Anodization of S-1 results in the progressive appearance of a redox signature that is in good agreement with that of a surface-tethered TEMPO control (S-2, black trace). The TEMPO coverage rises in increments of about 2.6×10^{-11} mol cm^{-2}, and reaches a maximum of ca. 1.31×10^{-10} mol cm^{-2}, equivalent to ca. 25% of a close-packed TEMPO monolayer assembled on a gold surface.

Reprinted with permission from Zhang, L, Noble, B B, Laborda, E, Darwish, N, Pluczyk, S, Le Brun, A P, Wallace, G G, Gonzalez, J, Coote, M L & Ciampi, S. "Electrochemical and Electrostatic Cleavage of Alkoxyamines." J. Am. Chem. Soc. 140 (2018a): 766-774. Copyright 2018, American Chemical Society

the features of this "invisible catalyst" is both timely and important.

Electrolytes and electrostatic interactions are ubiquitous in chemical, material and biological sciences. They dominate the entire reaction space in both natural and technological environments, such as cell membranes, fluidic channels, the confined electrolyte space of a porous electrode, and many other examples.

Ongoing research in this area has applications at the cutting-edge of synthetic organic electrochemistry (Zhang et al. 2018b), including the development of new microdevices such as electrostatic transistors for the electronics industry.

This work was supported by grants from the Australian Research Council (ARC, DE160400732 (S.C.), DE160101101 (N.D.), CE140100012 (L.Z., M.L.C., and G.G.W.) and FL110100196 (G.G.W.)). L.Z. would like to thank AINSE Ltd. for providing financial assistance (PGRA) and instrumental support (XRR).

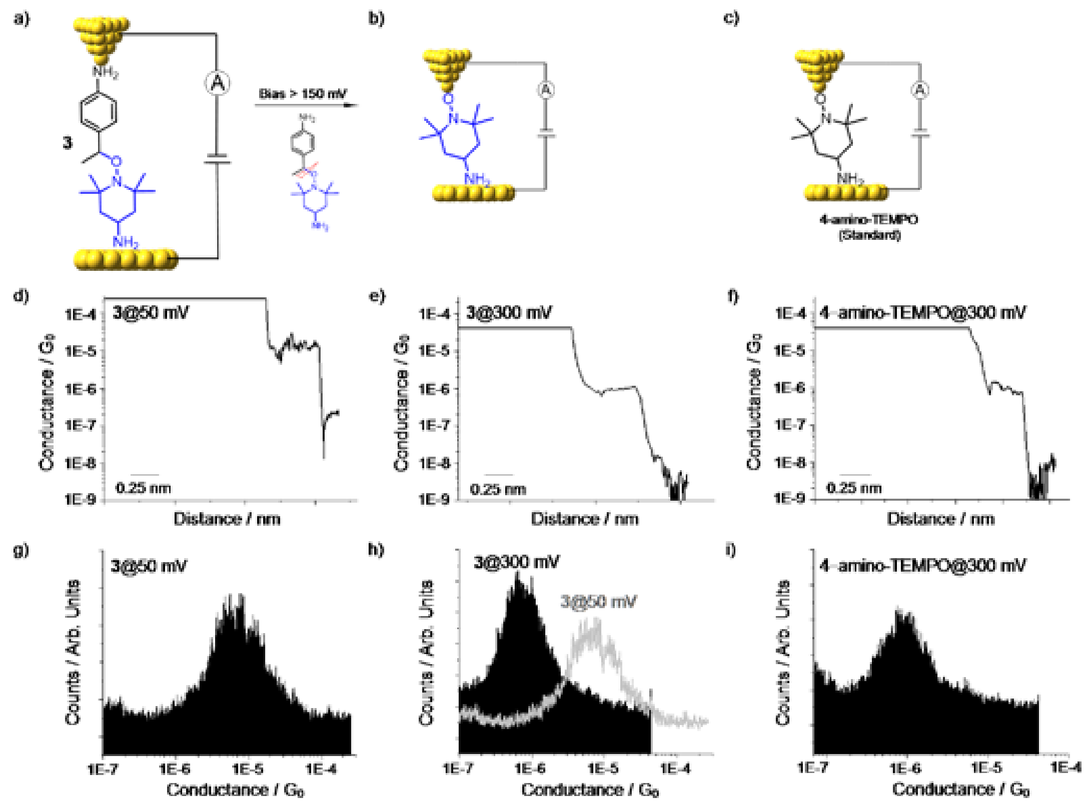


Figure 2: Electrostatic catalysis in the homolysis of alkoxyamines. (a-c) Schematic depiction of the STM-BJ setup for a single-molecule junction experiment used to investigate the effect of an external electrical field on the breaking of a C–ON bond. Single-molecule STM-BJ conductance measurements were used to probe the fate of the alkoxyamine molecule 1 under a variable electric field stimulus in a low dielectric solvent. The experiments capture discrete electrical signals from either the intact parent molecule 1 or from the putative 4-amino-TEMPO fragment that is produced upon the homolysis of 1. A STM tip is brought into and out of contact with an Au(111) surface while this is covered with a diluted solution of the molecule of interest (either 1 or a 4-amino-TEMPO standard in mesitylene/DCM, 10:1, v/v). The surface is biased against the tip and the current versus distance signal is collected as the tip is moved away from the surface. (d-f) Typical current versus distance traces with conductance plateaus indicative of a single-molecular junction. The current drops from the current-saturation value to the current-amplifier detection limit, passing through breakage steps, "plateaus", each of a specific conductance value. (g-i) Conductance histograms showing the electrical "fingerprints" of either the intact alkoxyamine 1 (i.e. before splitting, tip-surface bias < 150 mV) at 1E-5 G0 ($G_0 = (2e^2/h = 77.5$ µS, quantum of conductance) or the free nitroxide that is unmasked after splitting (bias > 150 mV) at 1E-6 G0. The molecular conductance obtained upon homolysis of 1, as shown in (h, 1@300 mV), is a perfect match of the results from control experiments where the two electrodes are forming junctions in a standard sample of commercial 4-amino-TEMPO (c,f,i).

Reprinted with permission from Zhang, L, Noble, B B, Laborda, E, Darwish, N, Pluczyk, S, Le Brun, A P, Wallace, G G, Gonzalez, J, Coote, M L & Ciampi, S. "Electrochemical and Electrostatic Cleavage of Alkoxyamines." J. Am. Chem. Soc. 140 (2018a): 766-774. Copyright 2018, American Chemical Society

References:

Zhang, L, Noble, B B, Laborda, E, Darwish, N, Pluczyk, S, Le Brun, A P, Wallace, G G, Gonzalez, J, Coote, M L & Ciampi, S 2018a, 'Electrochemical and electrostatic cleavage of alkoxyamines', *Journal of the American Chemical Society*, vol. 140, pp. 766–774.

Zhang, L, Domínguez-Espíndola, R B, Noble, B B, Gonçales, V R, Wallace, G G, Darwish, N, Coote, M L & Ciampi, S 2018b, 'Switchable interfaces: Redox monolayers on Si(100) by electrochemical trapping of alcohol nucleophiles', *Surfaces*, vol. 1, pp. 3–11.

Behind the scenes at the ion-beam Radiation Oncology Centre (i-ROCK) in Kanagawa.

Study Tour

Particle Therapy in Japan

Investigating the benefits of particle therapy

In August 2018, AINSE, with assistance from ANSTO, conducted a second Particle Therapy Tour in Japan hosted by AINSE Managing Director Michelle Durant and ANSTO Physicist Dr. Dale Prokopovich.

Proton- and carbon-ion particle therapy has been demonstrated to be a biologically-effective and cost-effective means of treating many types of cancers that are otherwise untreatable with traditional radiotherapy techniques. Japan has been using particle therapy techniques since 1994 and is considered a world leader in the field of particle therapy.

The first site visit was to the National Institute of Radiological Sciences (NIRS) in Chiba, where major advances in therapeutic application, experimental research, and new technology development have occurred in particle therapy. Delegates were able to participate in an in-depth technical tour of the Heavy Ion Medical Accelerator in Chiba (HIMAC), including the carbon ion superconducting gantry, and gain insights into the use of the facility for research and therapy from experts in the field.

The next visit was to the ion-beam Radiation Oncology Centre in Kanagawa

Attendees visiting the National Institute of Radiological Science (NIRS) in Chiba. From L to R: Dr Dale Prokopovich, Professor Annette Haworth, Ms Michelle Durant, Dr Peter Gorayski, Dr Tim Wang, Mr Hanh Vu, Dr Najmun Nahar, and Dr Atsushi Kitagawa.

Delegates from the medical and tertiary education sectors attended the AINSE study tour to discover how Japan has developed particle therapy from the early experimental stages through to patient treatments in the hospital setting. The principal component of the tour was three site visits to specialised particle therapy facilities.

(i-ROCK), where delegates were guided in the advanced application of particle therapy from both technical and therapeutic standpoints.

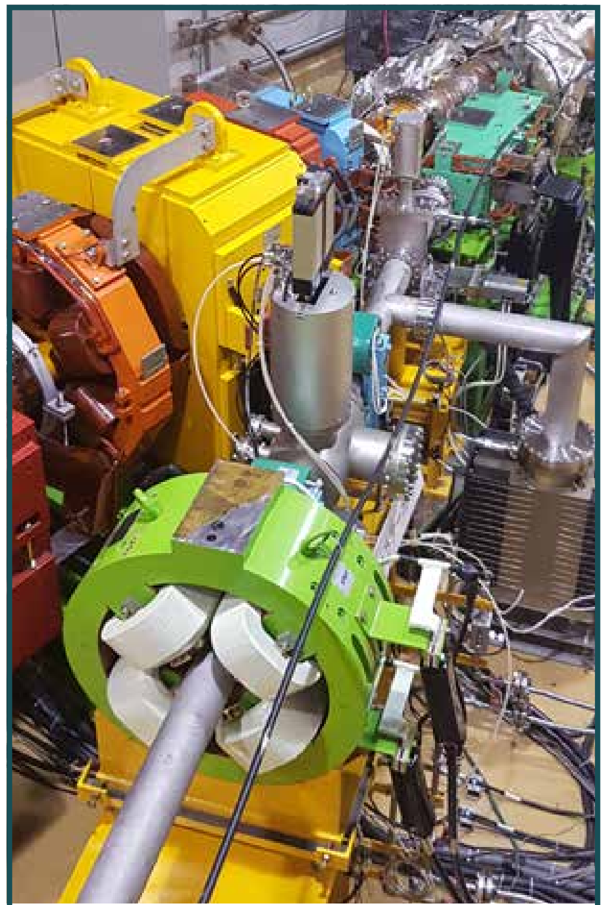
Concluding the tour was a visit to the a proton therapy centre at Tsukuba University. The participants were able to interact with the facility operators and ask

One of four treatment rooms at the ion-beam Radiation Oncology Centre (i-ROCK), Kanagawa.

questions relevant to how the operations of this proton facility might transfer to an Australian context.

Over the course of the Particle Therapy Tour, delegates gained an awareness of the most recent developments in particle therapy and its proven track record in Japan. Participants spoke with leading specialists involved in the development of particle therapy, as well as its subsequent implementation and treatment. At each location participants also had the opportunity to experience in-depth tours with these particle therapy experts.

The tour provided a unique perspective of particle therapy and the flow of this technology from a research tool through to its implementation for patient treatment in an operational hospital environment. The 2018 Study Tour significantly broadened the networking links between people interested in these facilities in Japan and Australia.



The Proton Injector in the Synchrotron at NIRS, Chiba.

Outreach Activities

AINSE Outreach Presence

February 2018 | Fukui Prefecture, Japan | Fukui International Meeting on Human Resource Development for Nuclear Energy in Asia

Michelle Durant represented Australia at the 8th annual forum, highlighting opportunities for AINSE and ANSTO to collaborate with Japan.

February 2018 | Canberra, Australia | Science Meets Parliament

Michelle Durant and three AINSE Councillors attended this event on behalf of AINSE. The event was organised by Science and Technology Australia.

April 2018 | Melbourne, Australia | 12th World Congress of the World Federation of Nuclear Medicine and Biology (WFNMB)

Michelle Durant and Elizabeth Geyer attended this event. AINSE provided travel support to a number of students from AINSE Member Universities to attend the conference, and hosted the Student Mixer event. Michelle Durant (AINSE Managing Director), Adi Paterson (ANSTO CEO) and two AINSE PGRA recipients spoke at the Student Mixer event.

May 2018 | Canberra, Australia | Science and Technology Australia CEO and Presidents' Forum

Professor Claire Lenehan attended this event on behalf of AINSE.

July 2018 | Sydney, Australia | Women in STEM and Entrepreneurship Presentation

Michelle Durant spoke to visitng students from Western Sydney University regarding the AINSE Women in STEM and Entrepreneurship School.

July 2018 | Melbourne, Australia | Australian Synchrotron New User Symposium

Michelle Durant ran an information booth and presented an overview of AINSE to research staff at ANSTO's Australian Synchrotron in Clayton, Victoria.

October 2018 | Sydney, Australia | AINSE Presentation to visiting VAEA Delegation

Michael Rose presented an overview of AINSE to visiting delegates from the Viet Nam Atomic Energy Agency (VAEA).

October 2018 | Brisbane, Australia | Science Meets Business

Professor Ian Gentle and Professor Roland De Marco attended this event on behalf of AINSE. The event was organised by Science and Technology Australia.

October 2018 | Melbourne, Australia | AS-AIMSS Information Session

Michelle Durant spoke to students from Melbourne University and Victoria University at an information session for the Australian Institute for Musculoskeletal Science (AIMSS) with the Australian Synchrotron (AS) held at the Western Centre for Health and Research Education.

October 2018 | Armidale, Australia | AINSE Presentation at The University of New England

Michelle Durant visited the University of New England to present an overview of AINSE programs and ANSTO facilities to senior faculty members.

AINSE's 60th Anniversary Dinner

On 27th November 2018, the 60th anniversary of AINSE was celebrated with a special banquet hosted at the Australian Museum.

The event brought together AINSE Councillors from universities across Australia and New Zealand, along with distinguished AINSE alumni and current AINSE postgraduate scholars, to share the stories of AINSE's past, present and future.

Over drinks and dinner, guests were able to interact with AINSE's rich sixty-year history by viewing hundreds of photos drawn from AINSE's archives and exploring displays of historical research publications.

Guests also heard from a series of distinguished speakers who played an influential role in shaping AINSE over the years. E A (Bill) Palmer (OBE), AINSE's first Executive Officer & Scientific Secretary, provided an insightful first-hand account of the first thirty years of AINSE's history, while Dennis Mather, former Managing Director of AINSE, related the challenges he faced in expanding AINSE's membership and transforming AINSE into a modern company.

After Ian Gentle and Simone Richter spoke on behalf of the AINSE Board and ANSTO, respectively, the evening's speeches were concluded by John White, fellow of the Australian Academy of Science and Professor at the Research School of Chemistry at the Australian National University. John drew on his pioneering career in the field of neutron scattering to reflect upon the ever-evolving challenges faced by Australian and New Zealand researchers over the years.

AINSE's current Managing Director Michelle Durant outlined her future vision for AINSE and thanked the assembled guests for their tireless contributions to AINSE over the years.

The event concluded with a ceremonial cake-cutting by AINSE leaders past and present.

Guests attending the 60th Anniversary celebrations in the Australian Museum's Westpac Long Gallery.

L to R: Dennis Mather, Bill Palmer, Michelle Durant and Ian Gentle cutting the AINSE Birthday Cake

Meetings and Committees

AINSE Council

Member Organisations and Representative at Council

Two Meetings of Council were held in 2018. There was an Annual General Meeting held on 23 May and a General Meeting held on 28 November.

(b) denotes AINSE Board Member.

MEMBER CODE	ORGANISATION	MEMBERSHIP COMMENCED	COUNCILLOR	MEETINGS ATTENDED
ACU	Australian Catholic University	2001	Dr Cliff Seery	2
ADE	The University of Adelaide	1958	Professor Chris Sumby	1
AKL	The University of Auckland	1995	Professor Jadranka Travas-Sejdic	1
ANS	ANSTO	1958	Professor Andrew Peele (b)	2
			Mrs Roslyn Hatton (b)	2
			Dr Suzanne Hollins (b)	2
ANU	The Australian National University	1958	Dr Anton Wallner	1
CAN	University of Canterbury	2005	Dr Vladimir Golovko	2
CBR	University of Canberra	1996	Professor Bill Maher	2
CDU	Charles Darwin University	1995	A/Professor Krishnan Kannoorpatti	2
CQU	CQ University	1991	Professor Owen Nevin	1
CSI	CSIRO	2010	Dr Nathan Webster	1
CSU	Charles Sturt University	1995	Dr Julia Howitt	1
CUR	Curtin University of Technology	1989	Professor Craig Buckley	2
DEA	Deakin University	1997	Professor Aaron Russell	1
DST	Defence Science & Technology Group	2016	Dr Ian Dagley	0
ECU	Edith Cowan University	1996	A/Professor Stephen Hinckley	2
FED	Federation University Australia	1997	A/Professor Kim Dowling	0
FLI	Flinders University	1966	Professor Claire Lenehan (President, b)	1
GRI	Griffith University	1975	Professor Evan Gray	2
JAM	James Cook University	1970	A/Professor Scott Smithers	0
LAT	La Trobe University	1966	Dr Andy Herries	1
MAC	Macquarie University	1966	Professor Barbara Messerle	0
MAS	Massey University	2014–2017 (rejoined 2018)	Professor Richard Haverkamp	2
MEL	The University of Melbourne	1958	Professor Colette Boskovic	1
MON	Monash University	1961	Professor Ian Smith	0
MUR	Murdoch University	1985–1997 (rejoined 1998)	Dr Aleks Nikoloski	1
NCT	The University of Newcastle	1965	Dr Grant Webber	2
NSW	The University of New South Wales	1958	A/Professor John Stride	2
OTA	University of Otago	2007	Professor Gary Wilson	1
QLD	The University of Queensland	1958	Professor Ian Gentle (b)	1
QUT	Queensland University of Technology	1992	Professor Godwin Ayoko	2
RMI	Royal Melbourne Institute of Technology	1988	Professor Gary Bryant	0
SCU	Southern Cross University	1994	Professor Bill Boyd	1

MEMBER CODE	ORGANISATION	MEMBERSHIP COMMENCED	COUNCILLOR	MEETINGS ATTENDED
SWI	Swinburne University of Technology	1991	Professor Saulius Juodkazis	1
SYD	The University of Sydney	1958–2015	Professor Laurent Rivory	1
		(rejoined 2017)	Professor Peter Lay	0
TAS	University of Tasmania	1958	Professor Andrew McMinn	0
THE	Theranostics Australia	2017	Dr Jerome Barley	0
UNE	The University of New England	1958	Dr Brendan Wilkinson	1
USA	University of South Australia	1991	Professor Enzo Lombi	1
USC	University of Sunshine Coast	2010	Professor John Bartlett	1
			Professor Roland De Marco (b)	1
UTS	University of Technology Sydney	1988	Professor Michael Cortie	2
UWA	The University of Western Australia	1958	A/Professor Pauline Grierson	0
UWS	Western Sydney University	1993	A/Professor Gary Dennis	0
VAC	The Vacuum Society of Australia	2018	Dr Anton Stampfl	1
VUW	Victoria University of Wellington	2010	Professor Mike Wilson	1
WAI	The University of Waikato	2011	A/Professor Graham Saunders	0
WOL	University of Wollongong	1975–2014 (rejoined 2016)	Professor Will Price	0
	AINSE		Ms Michelle Durant, Managing Director	2
	Independent Director		Mrs Helen Liossis (b)	2
	Independent Director		Dr Peter Coldrey (b)	1

Alternate Representatives and Other Attendees at Council

MEMBER CODE	ORGANISATION		REPRESENTATIVE	MEETINGS ATTENDED
AKL	The University of Auckland		A/Professor Duncan McGillivray	1
CQU	CQ University		Dr Nathan Brooks-English	1
CSU	Charles Sturt University		Dr Celia Barril	1
MAC	Macquarie University		Professor Robert Willows	1
			A/Professor Bridget Mabbutt	1
MEL	The University of Melbourne		Professor Damian Myers	1
MON	Monash University		Ms Julie Rothacker	2
QLD	The University of Queensland		A/Professor Patrick Moss	1
RMI	Royal Melbourne Institute of Technology		Dr Charlotte Conn	1
SCU	Southern Cross University		A/Professor Malcolm Clark	1
SWI	Swinburne University of Technology		Dr Rosalie Hocking	1
USA	University of South Australia		A/Professor Ivan Kempson	1
USC	University of the Sunshine Coast		Professor Marion Gray	1
UWA	The University of Western Australia		Dr Greg Skrzypek	1

OTHER ATTENDEES		REPRESENTATIVE	MEETINGS ATTENDED
AINSE		Mr Paul Graydon (Minute Secretary)	2
Delante Accountants & Business Advisors Pty Ltd		Mr David Aston (AINSE Auditor)	1

Seven private members were invited to attend.

AINSE Board Meetings

Seven Board Meetings were held in 2018.

EXECUTIVE MEMBER	OFFICE/POSITION	ORGANISATION	MEETINGS ATTENDED
Professor Claire Lenehan	President, University Representative	Flinders University	7
Ms Michelle Durant	Managing Director	AINSE	7
Ms Helen Liossis	Independent Director	Independent	7
Dr Peter Coldrey	Independent Director	Independent	5
Ms Roslyn Hatton	ANSTO Representative	ANSTO	7
Dr Suzanne Hollins	ANSTO Representative	ANSTO	5
Professor Andrew Peele	ANSTO Representative	ANSTO	7
Professor Ian Gentle	University Representative	The University of Queensland	5
Professor Roland De Marco	University Representative	University of the Sunshine Coast	2
Professor Lyndon Edwards	ANSTO Representative	ANSTO	*2

* Retired from the Board during 2018.

AINSE Winter School April Planning Meeting

Professor Thomas Millar	Dr Geraldine Jacobsen
Ms Michelle Durant	Dr Justin Bryan Davies
Ms Elizabeth Geyer	Professor Mihail Ionescu
Professor David Cohen	Dr Jamie Schulz
Dr Ken Short	

AINSE Honorary Fellows

At the Annual General Meeting of AINSE in May 2018, Emeritus Professor Robert Burford and Emeritus Professor Allan Chivas were formally recognised as Honorary Fellows of AINSE.

AINSE Honorary Fellows are awarded by the AINSE Council to individuals for distinguished and dedicated services to the Institute.

AINSE Gold Medal

At the AINSE General Meeting in November 2018, members voted to award Lydia Mackenzie from the University of Queensland with an AINSE Gold Medal for her outstanding PhD research.

AINSE Gold Medals are awarded by the AINSE Council for excellence in research based on publications over the last five years which acknowledge AINSE support.

L to R: AINSE President Professor Claire Lenehan, AINSE Managing Director Michelle Durant, Emeritus Professor Allan Chivas and Emeritus Professor Robert Burford at the presentation of the AINSE Honorary Fellows, May 2018.

AINSE Specialist Committees

The AINSE Managing Director is an ex-officio (non-voting) member of all Committees. Committees met in May and in October. The following members attended, (a) indicates 'alternate', (c) indicates 'AINSE Councillor'. The AGS and ENV committees were combined into one committee, AGES, and had their first combined meeting in October.

Archaeology and Geosciences Committee (AGS) May Meeting

A/Professor Patrick Moss (Convenor)	The University of Queensland
Dr Michael-Shawn Fletcher	The University of Melbourne
Dr Quan Hua	ANSTO
Dr Craig Sloss	Queensland University of Technology

Biomedical Science and Biotechnology Committee (BBS) May and October Meetings

Professor Damian Myers (Convenor) (c)	The University of Melbourne
Dr Ben Fraser	ANSTO
Dr Guo Jun Liu	ANSTO
Professor Elena Ivanova (Convenor)	Swinburne University of Technology
Professor Roger Price	The University of Western Australia
A/Professor Michael Hay	The University of Auckland
Dr Ingo Koeper	Flinders University
Dr Mark Tobin	ANSTO (Australian Synchrotron)
Dr Benjamin Blyth	Peter MacCallum Cancer Centre

Environmental Sciences Committee (ENV) May Meeting

Dr Greg Skrzypek (Convenor)	The University of Western Australia
A/Professor Paul Augustinus	The University of Auckland
Dr Dioni Cendon Sevilla	ANSTO
Professor Isaac Santos	Southern Cross University
Professor Andrew McMinn	University of Tasmania
Dr Henk Heijnis	ANSTO

Materials Science and Engineering Committee (MSE) May and October Meetings

Professor Gary Bryant (Convenor) (c)	RMIT University
Dr Aleks Nikoloski (c)	Murdoch University
Dr Victor Streltsov (Convenor)	The University of Melbourne
Dr Stephen Holt	ANSTO
Dr Garry McIntyre	ANSTO
Professor Mihail Ionescu (a)	ANSTO
Dr David Cohen	ANSTO
Professor Lyndon Edwards	ANSTO
Dr Ludovic Dumee	Deakin University
A/Professor Graham Saunders (c)	The University of Waikato

Archaeology, Geosciences and Environmental Sciences Committee (AGES) October Meeting

Dr Craig Sloss (Convenor)	Queensland University of Technology
Dr Greg Skrzypek	The University of Western Australia
A/Professor Paul Augustinus	The University of Auckland
Dr Dioni Cendon Sevilla	ANSTO
Professor Isaac Santos	Southern Cross University
Professor Andrew McMinn	University of Tasmania
Dr Henk Heijnis	ANSTO
Dr Agathe Lise-Pronovost	La Trobe University
Dr Lynda Petherick	Victoria University of Wellington
Dr Michael-Shawn Fletcher	The University of Melbourne

Finances

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Financial Statements
For the Financial Year Ended 31 December 2018

Contents

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Director's Report
For the Financial Year Ended 31 December 2018

Your Directors present their report on AINSE Limited (AINSE) for the financial year ended 31 December 2018.

Directors

The names of Directors in office at any time during or since the end of the year are:

Professor Claire Lenehan
Ms Michelle Durant
Dr Peter Coldrey
Ms Helen Liossis
Professor Ian Gentle
Professor Roland De Marco (commencement date 22 August 2018)
Professor Lyndon Edwards (cessation date 1 May 2018)
Dr Richard Garrett (cessation date 20 January 2018)
Ms Roslyn Hatton
Dr Suzanne Hollins (commencement date 2 May 2018)
Professor Andrew Peele (commencement date 9 February 2018)

Directors have been in office since the start of the financial year to the date of this report unless otherwise stated.

Principal Activities

The principal activities of AINSE during the financial year was to advance research, education and training in the field of nuclear science and engineering and related fields within Australasia by being, in particular, the key link between universities, ANSTO, other member organisations and major nuclear science and associated facilities.

AINSE's short-term objectives are to:

- Offer Postgraduate top up Scholarships, and Honours Scholarships to students from 41 University members for the conduct of research principally at ANSTO
- Organise educational schools and workshops in nuclear science and engineering for AINSE members
- Organise conferences in specific areas relating to nuclear science and engineering and in related fields that utilise nuclear techniques and analysis
- Support travel and accommodation for students and academics to present their AINSE supported research at conferences both within Australia and overseas

AINSE's long-term objectives are to:

- Be an effective link between all stakeholders of nuclear science and engineering
- Play an advocacy role for the Australasian nuclear community
- Play a leading role in nuclear education and training
- Facilitate the development of multilateral and multidisciplinary strategic research initiatives
- Utilise new streams of funding

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Director's Report
For the Financial Year Ended 31 December 2018

STRATEGIC PLAN (2013 – 2018)

AINSE's Vision

Enhancing Australia's capability in nuclear science and engineering by facilitating world-class research and education.

AINSE's Mission

AINSE will reach its vision through:

- Being an effective link between all stakeholders of nuclear science and engineering
- Playing an advocacy role for the Australasian nuclear community
- Playing a leading role in nuclear education and training
- Facilitating the development of multilateral and multidisciplinary strategic research initiatives
- Utilising new streams of funding

STRATEGIC PRIORITIES

AINSE has defined the following seven strategic priorities for its Strategic Plan. These will drive our focus, resource allocation and how we monitor our success over the life of the Strategic Plan.

1. **Effectively communicate AINSE's purpose to a wide range of different stakeholders**

   - Clearly enunciate AINSE's value proposition and align it with the priorities of Government, ANSTO and the Universities.
   - Enhance AINSE's outreach activities to reach a wider audience beyond nuclear scientists and engineers.
   - Work with outcome-focused advocacy groups to enhance the impact of nuclear technology.
   - Re-evaluate the metrics AINSE uses to measure and demonstrate its performance.
   - Constantly review how we best serve our stakeholders.

2. **Create an appropriate balance between funding project-based research and funding/facilitating multilateral and multidisciplinary collaboration**

   - Explore future opportunities for funded collaborative projects through workshops related to thematic areas.
   - Ensure continued relevance of AINSE programs.
   - Consider focused program style grants in strategic areas.
   - Maintain small grants opportunities.
   - Encourage a broad engagement within member organisations.

3. **Demonstrate leadership in the education of Australasia's next generation of scientists with an interest in nuclear science and engineering**

   - Expand AINSE's role in engaging the next generation of researchers with an interest in nuclear science.
   - Engage with Universities at the executive level to be aware of, and align with, Universities' strategic priorities.
   - Consider University accreditation for some AINSE activities (e.g. short/intensive courses).

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Director's Report
For the Financial Year Ended 31 December 2018

4. Develop AINSE's role as a credible advocate for the Australasian nuclear science and engineering community

- Maintain and strengthen AINSE's independence while providing value to ANSTO.
- Speak with a coherent voice representing universities on nuclear science and engineering.
- Become a facilitator of increasing industry awareness (e.g. promotions, training courses, education, and professional development).
- Maintain and further develop a network of experts to communicate the state of the art in nuclear science and technology.
- Draw on AINSE alumni as a resource of support and expertise.
- Develop and maintain a catalogue of key messages for decision makers.
- Provide leadership in the development of a decadal plan for nuclear infrastructure investment.

5. Provide an effective and efficient link between different capabilities related to nuclear science and engineering

- Support the user base across the facilities at ANSTO and other AINSE-supported facilities.
- Become a facilitator for collaboration and complementary use of scientific infrastructure.
- Effectively access the expertise within AINSE to facilitate optimum use of capabilities.
- Make effective use of the expertise and enthusiasm of ANSTO staff.
- Re-establish AINSE's reputation with the ARC and National Health and Medical Research Council (NHMRC) as credible lead organisation for funding proposals (e.g. Linkage Infrastructure Equipment and Facilities (LIEF), Centres of Excellence).

6. Seize new opportunities for funding beyond AINSE's traditional sources

- Be prepared to take advantage if/when new funding opportunities arise.
- Develop links with the philanthropy community through the AINSE Trust.
- Exploit our developed authority to leverage joint industry/government funding for innovation initiatives.
- Use our wide membership base and coherence as a credible argument to demonstrate an effective and efficient return on government/industry investment.

7. Diversify AINSE's membership and stakeholder base

- Increase the range of opportunities for existing members through flexible membership arrangements and new services.
- Review our membership fee calculation.
- Explore how to expand our stakeholder base, e.g. medical research organisations, international and environmental organisations, industry.

The Strategic Plan has been updated effective from 1 January 2019.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Director's Report
For the Financial Year Ended 31 December 2018

Information on Directors

The Directors in office at the date of this report are listed below with particulars of qualifications, experience and special responsibilities (if any).

Claire Lenehan – University Representative Director, President.
Board Member since March 2014.
20 years' experience in scientific research.
BSc (Hons), PhD, MRACI.

Michelle Durant – Managing Director.
Board Member since April 2016.
28 years' experience in scientific and business administration and management.
BSc, BFinAdmin, GradDipAppCorpGov, FGIA, FCIS.

Peter Coldrey – Independent Director.
Board Member since August 2012.
42 years' industrial research experience in the chemical and ophthalmic lens industries.
FTSE, BE,PhD, BCom.

Helen Liossis – Independent Director.
Board member since January 2018.
31 years' experience in finance roles (including Chief Operating Officer, Head of Investor Relations and other senior executive roles).
Currently the Head of Corporate Strategy and Business Planning at Sydney Water.
BBus (Accounting and Economics), MBA, CPA, GAICD.

Roland De Marco – University Representative Director.
Board Member since August 2018.
28 years' experience in CSIRO, academia, scientific research as well as Research Leadership and Management.
BSc, MSc, PhD, FRACI.

Ian Gentle -- University Representative Director.
Board Member since August 2014.
36 years' experience in academia and scientific research and research management.
BSc (Hons), PhD, MRACI.

Roslyn Hatton – ANSTO Representative Director.
Board Member representing ANSTO since December 2014.
Independent Board Member from August 2012 until September 2014.
27 years in public (ANAO) and private (Ernst & Young) sector audit and 8 years at the Commonwealth Bank in a financial accounting role.
Deputy Chief Financial Officer at ANSTO.
BComm (Accounting, finance and information systems) UNSW FCA.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Director's Report
For the Financial Year Ended 31 December 2018

Information on Directors continued

Suzanne Hollins – ANSTO Representative Director.
Board member since May 2018.
21 years' experience in scientific research and research management.
Head of Research at ANSTO.
BSc(Hons), PhD.

Andrew Peele – ANSTO Representative Director.
Board member since February 2018.
26 years' experience in academia, scientific research and science management in Australia and USA. Previous legal experience as a practicing solicitor in Victoria.
BSc (hons), PhD, LLB, Grad Dip (Intellectual Property), MAIP, FTSE.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Director's Report
For the Financial Year Ended 31 December 2018

Meetings of Directors

During the financial year, 7 meetings of directors were held. Attendances by each director were as follows:

	Number eligible to attend	Number attended
Professor Claire Lenehan	7	7
Ms Michelle Durant	7	7
Dr Peter Coldrey	7	5
Ms Helen Liossis	7	7
Professor Roland De Marco	2	2
Professor Ian Gentle	7	5
Professor Lyndon Edwards	2	2
Dr Richard Garrett	0	0
Ms Roslyn Hatton	7	7
Dr Suzanne Hollins	5	5
Professor Andrew Peele	7	7

AINSE is incorporated under the *Corporations Act 2001* and is a company limited by guarantee. If AINSE is wound up, the constitution states that each member is required to contribute a maximum of $10 each towards meeting any outstanding obligations of AINSE. At 31 December 2018, the total amount that members of AINSE are liable to contribute if AINSE is wound up is $520 (2017: $520).

Auditors Independence Declaration

The lead auditor's independence declaration for the year ended 31 December 2018 has been received and can be found on page 56 of the report.

Signed in accordance with a resolution of the Board of Directors.

Director
Suzanne Hollins

Director
Michelle Durant

Dated this 25th day of March 2019

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Auditor's Independence Declaration to the Directors
For the Financial Year Ended 31 December 2018

In accordance with the requirements of section 60-40 of the *Australian Charities and Not-for-profits Commission Act 2012*, I declare that, to the best of my knowledge and belief, during the year ended 31 December 2018 there have been no contraventions of:

i. The auditor independence requirements as set out in the *Australian Charities and Not-for-profits Commission Act 2012* in relation to the audit; and

ii. Any applicable code of professional conduct in relation to the audit.

Delante Accountants and Business Advisers Pty Ltd
Chartered Accountants

David G Aston
Director

TAREN POINT NSW 2229

Dated 25 March 2019

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Statement of Comprehensive Income – By Nature
For the Financial Year Ended 31 December 2018

	Note	2018 $	2017 $
Revenue	2	1,671,605	1,670,370
External grants	2	129,182	96,824
Other income	2	106,299	104,564
Total income		1,907,086	1,871,758
Employee benefits expense		(528,942)	(457,724)
Depreciation expense	3	(4,056)	(11,385)
Audit, legal and consultancy expense		(29,869)	(32,124)
AINSE Awards		(848,826)	(734,916)
Other expenses		(418,529)	(336,416)
Total Expenses		(1,830,222)	(1,572,565)
Surplus/(deficit) before income tax		**76,864**	**299,193**
Income tax expense		-	-
Surplus/(deficit) for the year		**76,864**	**299,193**

The accompanying notes form part of these financial statements

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Statement of Financial Position
As At 31 December 2018

	Note	2018 $	2017 $
ASSETS			
CURRENT ASSETS			
Cash and cash equivalents	4	3,501,658	3,084,641
Trade and other receivables	5	177,791	150,055
Other	6	17,767	15,940
TOTAL CURRENT ASSETS		3,697,216	3,250,636
NON-CURRENT ASSETS			
Property, plant & equipment	7	11,355	15,411
TOTAL NON-CURRENT ASSETS		11,355	15,411
TOTAL ASSETS		3,708,571	3,266,047
LIABILITIES			
CURRENT LIABILITIES			
Trade and other payables	8	501,095	103,475
Employees provisions	9	64,630	104,592
TOTAL CURRENT LIABILITIES		565,725	208,067
NON-CURRENT LIABILITIES			
Employees provisions	9	16,932	8,930
TOTAL NON-CURRENT LIABILITIES		16,932	8,930
TOTAL LIABILITIES		582,657	216,997
NET ASSETS		3,125,914	3,049,050
EQUITY			
Awards reserve	12	736,769	716,676
Accumulated surplus		2,389,145	2,332,374
TOTAL EQUITY		3,125,914	3,049,050

The accompanying notes form part of these financial statements

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Statement of Changes in Equity
For the Financial Year Ended 31 December 2018

	Awards Reserve $	Accumulated Surplus $	Total $
Balance at 1 January 2017	875,887	1,873,970	2,749,857
Net surplus/(deficit) attributable to AINSE	-	299,193	299,193
Transfers to and from awards reserve	(159,211)	159,211	-
Balance at 31 December 2017	716,676	2,332,374	3,049,050
Net surplus/(deficit) attributable to AINSE	-	76,864	76,864
Transfers to and from awards reserve	20,093	(20,093)	-
Balance at 31 December 2018	736,769	2,389,145	3,125,914

The accompanying notes form part of these financial statements

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Cash Flow Statement
For the Financial Year Ended 31 December 2018

	2018 $	2017 $
CASH FLOWS FROM OPERATING ACTIVITIES		
Receipts from operations	1,874,458	1,674,186
Receipts from grants	532,895	175,182
Interest received	83,889	67,810
Award related payments	(1,075,474)	(826,976)
Payments to suppliers and employees	(998,751)	(735,074)
Net cash generated from operating activities	**417,017**	**355,128**
CASH FLOWS FROM INVESTING ACTIVITIES		
Payment for property, plant and equipment	-	(5,469)
Net cash used in investing activities	**-**	**(5,469)**
Net increase / decrease in cash held	**417,017**	**349,659**
Cash and cash equivalents at beginning of financial year	3,084,641	2,734,982
Cash and cash equivalents at end of financial year	**3,501,658**	**3,084,641**

The accompanying notes form part of these financial statements

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

Note 1 – Statement of Significant Accounting Policies

The financial statements cover AINSE Limited (AINSE) as an individual entity. AINSE is a Company limited by guarantee, incorporated and domiciled in Australia.

Basis of Preparation

AINSE applies the Australian Accounting Standards – Reduced Disclosure Requirements as set out in AASB 1053: Application of Tiers of Australian Accounting Standards and AASB 2010-2: Amendments to Australian Accounting Standards arising from Reduced Disclosure.

The financial statements are general purpose financial statements that have been prepared in accordance with Australian Accounting Standards – Reduced Disclosure Requirements of the Australian Accounting Standards Board and the *Australian Charities and Not-for-profits Commission Act 2012.* AINSE is a not-for-profit entity for financial reporting purposes under Australian Accounting Standards.

Australian Accounting Standards set out accounting policies that the AASB has concluded would result in financial statements containing relevant and reliable information about transactions, events and conditions. Material accounting policies adopted in the preparation of these financial statements are presented below and have been consistently applied unless stated otherwise.

The financial statements, except for the cash flow information, have been prepared on an accruals basis and are based on historical costs, modified, where applicable, by the measurement at fair value of selected non-current assets, financial assets and financial liabilities. The amounts presented in the financial statements have been rounded to the nearest dollar.

The financial statements were authorised for issue on 20 March 2019 by the directors of AINSE.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

Significant Accounting Policies

Revenue and Other Income

Grant revenue is recognised in the statement of comprehensive income when AINSE obtains control of the grant, it is probable that the economic benefits gained from the grant will flow to AINSE and the amount of the grant can be measured reliably.

If conditions are attached to the grant which must be satisfied before it is eligible to receive the contribution, the recognition of the grant as revenue will be deferred until those conditions are satisfied.

When grant revenue is received whereby AINSE incurs an obligation to deliver economic value directly back to the contributor, this is considered a reciprocal transaction and the grant revenue is recognised in the statement of financial position as a liability until the service has been delivered to the contributor, otherwise the grant is recognised as income on receipt.

Donations and bequests are recognised as revenue when received.

Interest revenue is recognised using the effective interest method, which for floating rate financial assets is the rate inherent in the instrument.

Revenue from the rendering of a service is recognised upon the delivery of the service to the customers.

All revenue is stated net of the amount of goods and services tax.

Property, Plant and Equipment

Each class of property, plant and equipment is carried at cost or fair value as indicated less, where applicable, any accumulated depreciation and impairment losses.

Plant and Equipment

Plant and equipment are measured on the cost basis and are therefore carried at cost less accumulated depreciation and any accumulated impairment losses. In the event the carrying amount of plant and equipment is greater than its estimated recoverable amount, the carrying amount is written down immediately to its estimated recoverable amount and impairment losses are recognised either in profit or loss or as a revaluation decrease if the impairment losses relate to a revalued asset. A formal assessment of recoverable amount is made when impairment indicators are present.

Plant and equipment that have been contributed at no cost, or for nominal cost, are valued and recognised at the fair value of the asset at the date it is acquired.

Depreciation

The depreciable amount of all fixed assets including buildings and capitalised leased assets, but excluding freehold lands, are depreciated on a straight line or diminishing value basis over their useful lives to AINSE commencing from the time the asset is held ready for use. Leasehold improvements are depreciated over the shorter of either the unexpired period of the lease or the estimated useful life of the improvement.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

The depreciation rates used for each class of depreciable asset are:

Plant & equipment	15-35%
Motor vehicles	25%
Furniture and fittings	10-25%

The asset's residual values and useful lives are reviewed, and adjusted if appropriate, at the end of each reporting period.

Gains and losses on disposals are determined by comparing proceeds with the carrying amount. These gains or losses are included in the statement of comprehensive income. When revalued assets are sold, amounts included in the revaluation reserve relating to that asset are transferred to retained earnings.

Financial Instruments

AINSE's financial instruments consist mainly of deposits with banks, local money market instruments, short-term investments and accounts receivable and payable.

Initial Recognition & Measurement
Financial assets and financial liabilities are recognised when AINSE becomes a party to the contractual provisions to the instrument. Financial Instruments are initially measured at fair value plus transaction costs, except where the instrument is classified "at fair value through profit or loss" in which case transaction costs are recognized immediately as expenses in profit or loss. Subsequent to initial recognition these instruments are measured as set out below.

Classification and Subsequent Measurement
Financial instruments are subsequently measured at either fair value, amortised cost using the effective interest method, or cost. Where available, quoted prices in an active market are used to determine fair value. In other circumstances, valuation techniques are adopted.

Amortised cost is calculated as the amount at which the financial asset or financial liability is measured at initial recognition less principal payments and any reduction for impairment and adjusted for any cumulative amortisation of the difference between that initial amount and the maturity amount calculated using the effective interest method.

Fair Value
Fair value is determined based on current bid prices for all quoted investments. Valuation techniques are applied to determine the fair value for all unlisted securities, including recent arm's length transactions, reference to similar instruments and option pricing models.

Loans and Receivables
Loans and receivables are non-derivative financial assets with fixed or determinable payments that are not quoted in an active market and are subsequently measured at amortised cost. Gains or losses are recognized in profit or loss through the amortization process and when the financial asset is derecognized.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

Held-to-Maturity Investments

Held-to-maturity investments are non-derivative financial assets that have fixed maturities and fixed or determinable payments, and it is the entity's intention to hold these investments to maturity. They are subsequently measured at cost. Gains and losses are recognised in profit and loss through the amortisation process and when the financial asset is derecognized.

Financial Liabilities

Non-derivative financial liabilities (excluding financial guarantees) are subsequently measured at amortised cost. Gains or losses are recognised in profit or loss through the amortization process and when the financial liability is derecognized.

Impairment of Assets

At the end of each reporting period, AINSE assesses whether there is objective evidence that a financial asset has been impaired. A financial asset (or a group of financial assets) is deemed to be impaired if, and only if, there is objective evidence of impairment as a result of one or more events (a "loss event") having occurred, which has an impact on the estimated future cash flows of the financial asset(s).

In the case of financial assets carried at amortised cost, loss events may include: indications that the debtors or a group of debtors are experiencing significant financial difficulty, default or delinquency in interest or principal payments; indications that they will enter bankruptcy or other financial reogranisation; and changes in arrears or economic conditions that correlate with defaults.

For financial assets carried at amortised cost (including loans and receivables), a separate allowance account is used to reduce the carrying amount of financial assets impaired by credit losses. After having taken all possible measures of recovery, if management establishes that the carrying amount cannot be recovered by any means, at that point the written off amounts are charged to the allowance account or the carrying amount of impaired financial assets is reduced directly if no impairment amount was previously recognized in the allowance account.

When the terms of financial assets that would otherwise have been past due or impaired have been renegotiated, AINSE recognises the impairment for such financial assets by taking into account the original terms as if the terms have not been renegotiated so that the loss events that have occurred are duly considered.

Employee Benefits

Provision is made for AINSE's liability for employee benefits arising from services rendered by employees at the end of the reporting period. Employee benefits that are expected to be settled within one year have been measured at the amounts expected to be paid when the liability is settled. Other employee benefits payable later than one year have been measured at the present value of the estimated future cash outflows to be made for those benefits.

Cash and Cash Equivalents

Cash and cash equivalents include cash on hand, deposits held at-call with banks, other short-term highly liquid investments with original maturities of three months or less, and bank overdrafts. Bank overdrafts are shown within short term borrowings in current liabilities on the statement of financial position.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

Goods and Services Tax (GST)

Revenues, expenses and assets are recognised net of the amount of GST, except where the amount of GST incurred is not recoverable from the Australian Taxation Office (ATO).

Receivables and payables are stated inclusive of the amount of GST receivable or payable. The net amount of GST recoverable from, or payable to, the ATO is included with other receivables or payables in the statement of financial position.

Cash flows are presented on a gross basis. The GST components of cash flows arising from investing or financing activities which are recoverable from, or payable to, the ATO are presented as operating cash flows included in receipts from customers or payments to suppliers.

Income Tax

AINSE Limited is exempt from income tax under section 50-5 of the *Income Tax Assessment Act 1997 as AINSE is established for the purpose of enabling scientific research to be conducted in Australia.*

Trade and Other Payables

Trade and other payables represent the liabilities for goods and services received by AINSE during the reporting period that remain unpaid at the end of the reporting period. The balance is recognised as a current liability with the amounts normally paid within 30 days of recognition of the liability.

Description of Awards Reserve

The awards reserve represents the future commitments for funding to scientists for research in two categories: AINSE supported facility awards and Postgraduate Research Awards. AINSE supported facility awards provide opportunities for researchers to access equipment that complements the facilities at ANSTO and are available for a period of 12 months. Postgraduate Research Awards provide support to post graduate students at an entry point in their qualification and last for the duration of their underlying primary scholarship.

Comparative Figures

When required by Accounting Standards, comparative figures have been adjusted to conform to changes in presentation for the current financial year.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

	Note	2018 $	2017 $
Note 2 – Revenue and Other Income			
Revenue			
Payments from members		1,228,455	1,234,370
ANSTO promotion fee		443,150	436,000
		1,671,605	1,670,370
External grants	13	129,182	96,824
		1,800,787	1,767,194
Other income			
Conference registrations		25,751	22,734
Sponsorships		-	-
Interest received		75,537	68,980
Other income		5,011	12,850
		106,299	104,564
Total revenue and other income		1,907,086	1,871,758
Note 3 – Surplus for the Year			
The surplus for the year has been determined after charging as expenses:			
Depreciation of property, plant and equipment		4,056	11,385
Bad and doubtful debts		-	-
Note 4 – Cash and Cash Equivalents			
Cash at bank		3,500,658	3,083,641
Cash on hand		1,000	1,000
Total cash and cash equivalents		3,501,658	3,084,641
Note 5 – Trade and Other Receivables			
Trade receivables		12,346	15,079
Less: Provision for impairment		-	-
		12,346	15,079
Other receivables		165,445	134,976
Total trade and other receivables		177,791	150,055
Note 6 – Other Current Assets			
Accrued interest		6,043	14,395
Prepayments		11,724	1,545
Total other current assets		17,767	15,940

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

	Note	2018 $	2017 $
Note 7 – Property, Plant and Equipment			
Plant and equipment – cost		17,300	17,300
Less: Accumulated depreciation		(8,042)	(6,083)
		9,258	11,217
Furniture and fittings – cost		10,485	10,485
Less: Accumulated depreciation		(8,388)	(6,291)
		2,097	4,194
Motor vehicles – cost		45,613	45,613
Less: Accumulated depreciation		(45,613)	(45,613)
		-	-
Total property, plant and equipment		11,355	15,411

a. Movements in Carrying Amounts

Movements in the carrying amounts for each class or property, plant and equipment between the beginning and the end of the current financial year.

	Plant & Equipment $	Furniture & Fittings $	Motor Vehicles $	Total $
Balance at 1 January 2018	11,217	4,194	-	15,411
Depreciation	(1,959)	(2,097)	-	(4,056)
Balance at 31 December 2018	9,258	2,097	-	11,355

	Note	2018 $	2017 $
Note 8 – Trade and Other Payables			
Trade and other payables		24,488	21,959
Grants received – in advance	13	472,676	78,358
Employees – accrued salary and wages		3,931	3,158
Total trade and other payables		501,095	103,475

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

	2018 $	2017 $
Note 9 – Employee Provisions		
CURRENT		
Annual leave	39,232	57,708
Long service leave	25,398	46,884
	64,630	104,592
NON-CURRENT		
Long service leave	16,932	8,930
	16,932	8,930
Total employee provisions	81,562	113,522

Note 10 – Key Management Personnel Compensation

Any person(s) having authority and responsibility for planning, directing and controlling the activities of the entity, directly or indirectly, including any director (whether executive or otherwise) of that entity is considered key management personnel.

The totals of remuneration paid to key management personnel of AINSE during the years are as follows:

	2018 $	2017 $
Key management personnel compensation	219,769	216,307

Compensation includes salary and wages, superannuation and fringe benefits.

Key management personnel compensation includes a rate of $1,000 per meeting provided to Independent Board Members.

Note 11 – Other Related Party Transactions

There were no related party transactions during the financial year.

Note 12 – Awards Reserve

	2018 $	2017 $
Opening balance at 1 January	716,676	875,887
Transfer to and (from) awards reserve	20,093	(159,211)
Balance as at 31 December	736,769	716,676

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

	2018 $	2017 $
Note 13 – External Grants		
GRANTS REVENUE		
New Fund	75,090	55,750
Continuing Residential Student Scholarship Funding	35,500	-
Women in STEM and Entrepreneurship (WISE)	3,000	35,000
Scholarship AINSE ANSTO French Embassy (SAAFE)	15,592	6,074
	129,182	96,824
Grants Received in Advance		
New Fund	446,160	46,250
Women in STEM and Entrepreneurship (WISE)	10,000	-
Scholarship AINSE ANSTO French Embassy (SAAFE)	16,516	32,108
	472,676	78,358

Note 14 – Financial Risk Management

AINSE's financial instruments consist mainly of deposits with banks, local money market Instruments, short-term investments, accounts receivable and payable, and leases.

The carrying amounts of each category of financial instruments, measured in accordance with AASB 139 as detailed in the accounting policies to these financial statements, are as follows:

	2018 $	2017 $
Financial Assets		
Cash and cash equivalents	3,501,658	3,084,641
Trade and other receivables	177,791	150,055
Total financial assets	3,679,449	3,234,696
Financial Liabilities		
Trade & other payables	501,095	103,476
Total financial liabilities	501,095	103,476

Note 15 – Events after the Reporting Date

The Directors are not aware of any significant events since the end of the reporting period.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Notes to and Forming Part of the Financial Statements
For the Financial Year Ended 31 December 2018

Note 16 – Company Details

AINSE's principal place of business is:

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
New Illawarra Road
LUCAS HEIGHTS NSW

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Directors' Declaration
For the Financial Year Ended 31 December 2018

The Directors of AINSE Limited (AINSE) declare that:

1. The financial statements and notes, as set out on pages 57 to 70 satisfy the requirements of the *Australian Charities and Not-for-profits Commission Act 2012* and *Not-for-profits Commission Regulation 2013*, and;

   (a) comply with Australian Accounting Standards – Reduced Disclosure Requirements, and

   (b) give a true and fair view of the financial position as at 31 December 2018 and of its performance for the year ended on that date.

2. In the directors' opinion there are reasonable grounds to believe that AINSE will be able to pay its debts as and when they become due and payable

This declaration is made in accordance with a resolution of the Board of Directors.

Director
Suzanne Hollins

Director
Michelle Durant

Dated this 25th day of March 2019

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Independent Auditor's Report to the Members of
AINSE Limited
For the Financial Year Ended 31 December 2018

Audit Opinion

Opinion

We have audited the financial report of AINSE Limited (AINSE), which comprises the statement of financial position as at 31 December 2018, and the statement of comprehensive income, statement of changes in equity and cash flow statement for the year then ended, and notes to the financial statements, including a summary of significant accounting policies, and the declaration by those charged with governance.

In our opinion, the accompanying financial report of AINSE is prepared, in all material respects, in accordance with *the Australian Charities and Not-for-profits Commission Act 2012, the Not-for-profits Commission Regulation 2013*.

Basis for Opinion

We conducted our audit in accordance with Australian Auditing Standards. Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Report* section of our report. We are independent of AINSE in accordance with the ethical requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants* (the Code) that are relevant to our audit of the financial report in Australia. We have also fulfilled our other responsibilities in accordance with the Code. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Information Other than the Financial Report and Auditor's Report Thereon

Those charged with governance are responsible for the other information. The other information comprises the information included in AINSE's annual report for the year ended 31 December 2018 but does not include the financial report and our auditor's report thereon.

Our opinion on the financial report does not cover the other information and accordingly we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial report, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial report or our knowledge obtained in the audit or otherwise appears to be materially misstated.

If, based on the work we have performed, we conclude that there is a material misstatement of this other information; we are required to report that fact. We have nothing to report in this regard.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Independent Auditor's Report to the Members of
AINSE Limited
For the Financial Year Ended 31 December 2018

Responsibilities of Management and Those Charged with Governance for the Financial Report

Management is responsible for the preparation of the financial report in accordance with *the Australian Charities and Not-for-profits Commission Act 2012, the Not-for-profits Commission Regulation 2013*, and for such internal control as management determines is necessary to enable the preparation of the financial report that is free from material misstatement, whether due to fraud or error.

In preparing the financial report, management is responsible for assessing AINSE's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate AINSE or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing AINSE's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Report

Our objectives are to obtain reasonable assurance about whether the financial report as a whole is free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with Australian Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial report.

A further description of our responsibilities for the audit of the financial report is detailed in Appendix A to the Auditor's Report.

Delante Accountants and Business Advisers Pty Ltd
Chartered Accountants

David G Aston
Director

TAREN POINT NSW 2229

Dated 25 March 2019

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Independent Auditor's Report to the Members of
AINSE Limited
For the Financial Year Ended 31 December 2018

APPENDIX A to the Auditor's Report

As part of an audit in accordance with Australian Auditing Standards, we exercise professional judgement and maintain professional scepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial report, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- Obtain an understanding of internal control relevant to the audit in order to design procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of AINSE's internal control.

- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on AINSE's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial report or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause AINSE to cease to continue as a going concern.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Auditor's Disclaimer
For the Financial Year Ended 31 December 2018

The additional data presented in the Detailed Profit & Loss Statement is in accordance with the books and records of AINSE Limited (AINSE), which have been subjected to the auditing procedures applied in the statutory audit of AINSE for the year ended 31 December 2018.

It will be appreciated that the statutory audit did not cover all details of the financial data and no warranty of accuracy or reliability is given. Neither the firm nor any member or employee of the firm undertakes responsibility in any way whatsoever to any person (other than AINSE) in respect of such data, including any errors or omissions therein however caused.

Delante Accountants and Business Advisers Pty Ltd
Chartered Accountants

David G Aston
Director

TAREN POINT NSW 2229

Dated 25 March 2019

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Detailed Profit & Loss Statement
For the Financial Year Ended 31 December 2018

		2018 $		2017 $
Operating Revenue				
Payments from Members		1,228,455		1,234,370
ANSTO Promotion Fee		443,150		436,000
External Grants		129,182		96,824
Interest Received		75,537		68,980
Conference Registrations		25,751		22,734
Other Income		5,011		12,850
Total Operating Revenue		1,907,086		1,871,758
Operating Expenses				
Wages & Salaries		461,500		397,896
Superannuation		67,442		59,828
AINSE Awards				
Postgraduate Awards				
ANSTO Facility Consumables	11,800		-	
Travel & Accommodation	88,500		84,101	
Stipends	736,339		638,157	
		836,639		722,258
Winter School Administration		9,914		10,658
Research Awards				
AINSE Supported Facility	2,273		2,000	
		2,273		2,000
Conference Subsidies		128,878		92,060
Conference Management		88,274		68,178
Publication & Promotions		42,485		28,283
Meetings & Committees		72,832		81,519
AINSE Secretariat				
Administration & Staff Training	5,646		9,974	
Audit Fees	23,180		21,397	
Bank Charges	1,129		748	
Books & Software	-		4,008	
Consultancy Fees	6,689		6,452	
Contractors – Office Staff	25,272		-	
Credit Card Expense	29		15	
Depreciation	4,056		11,385	
Entertaining	377		213	
FBT Expense & Payments	1,201		4,954	
Insurance	13,644		11,075	
Legal Expenses	-		4,275	
Miscellaneous	17,651		12,594	

The Australian Institute of Nuclear Science and Engineering
AINSE Limited
ABN 18 133 225 331
Detailed Profit & Loss Statement
For the Financial Year Ended 31 December 2018

		2018 $		2017 $
Office Supplies	6,493		3,058	
Postage & Telephone	838		1,097	
Staff Recruitment	1,035		790	
Travel & Accommodation	6,736		9,498	
Vehicle Expenses	6,009		8,352	
		119,985		109,885
Total Operating Expenses		1,830,222		1,572,565
Surplus for the Year		76,864		299,193

WISE School

Women in STEM and Entrepreneurship

Inspiring and supporting the next generation of female leaders in STEM

AINSE's second annual Women in STEM and Entrepreneurship (WISE) School saw fifty-seven students from thirty-two universities across Australia and New Zealand join a diverse group of scientists, engineers, and distinguished guests to network and share their experiences.

In 2018, AINSE received funding from ANSTO and the Office of the NSW Chief Scientist & Engineer within the NSW Department of Industry to hold a school specifically targeted towards first-year female students, with an emphasis on Women in STEM and their career opportunities within nuclear science and engineering. AINSE invited each of its thirty-five Australian and six New Zealand member universities to nominate students to attend the program.

In the first week of December, the cohort of first-year female students travelled to ANSTO's Sydney campus in Lucas Heights where AINSE hosted the 2018 WISE School. Over the course of the three-day intensive program, students engaged in networking and social activities, met high-profile women in nuclear science and engineering, and participated in panel discussions and tours of ANSTO's landmark research infrastructure.

The WISE School was opened on December 5 by AINSE Managing Director Michelle Durant, who provided students with an overview of AINSE and the opportunities it provides to students and early-career researchers. Michelle later shared her personal journey through a career spanning from research to science outreach and Managing Director of a science-and-engineering-based organisation.

Over the course of the WISE School, students also heard from special guest speakers Prof. Madhu Bhaskaran, Research Leader at RMIT University; Siobhan Tobin, ANSTO Graduate Physicist, Rhodes Scholar and Director of the Australian Physics Olympiad; Susie Gemmell, Engagement Director at the Sydney School of Entrepreneurship; and Erica Smyth AC, professional Company Director and former geologist.

> *"A valuable experience for young women to learn not only about possible future careers in STEM, but how they can inspire change in the field."*
>
> *- anonymous survey feedback, WISE 2018*

A series of panel discussions covered a broad range of topics, from effective professional networking to student life and career opportunities. Panellists included Dr. Anna Paradowska, Sarah Ballantyne and Tim Boyle from ANSTO; AINSE students Katie Colborn, Paige Bromson and Mitch Klenner; president of Women in Nuclear's Australia chapter and Superstar

p.78, clockwise from top: Siobhan Tobin discussing the opportunities that led her to a Rhodes Scholarship; Dr. Joanne Lackenby, Julia Garside and Sarah Ballantyne taking questions during a panel discussion; Michelle Durant sharing her career journey; and the WISE School 2018 alumni (photo credit: Bruce Hudson).

of STEM Dr. Joanne Lackenby; and president of AusYGN and Chair of Young Engineers in Australia Julia Garside.

ANSTO CEO Dr. Adi Paterson also visited the students to share his personal accounts of the female trailblazers in his family and his goals and experiences as a Male Champion of Change.

A key component of the WISE School is an ongoing mentorship program involving the WISE students, past WISE alumni, and staff members from ANSTO and AINSE. A networking dinner held on the second day of the school allowed mentors and mentees to meet and discuss the challenges and opportunities present in STEM careers generally, and in the fields of nuclear science and engineering specifically. These conversations will continue through a series of scheduled videoconferences that will run throughout 2019.

Prof. Madhu Bhaskaran passing on advice gained over the course of a successful career in STEM.

AINSE would like to thank our guest speakers and mentors for their key efforts in making the 2018 WISE School a success, as well as ANSTO and the Office of the NSW Chief Scientist & Engineer within the NSW Department of Industry for their funding support. We look forward to hearing from our 2018 WISE alumni as they continue their journeys to successful careers in STEM.


Dr. Joanne Lackenby (second from left), president of WiN Australia, meets students from the 2018 WISE cohort during a networking dinner.

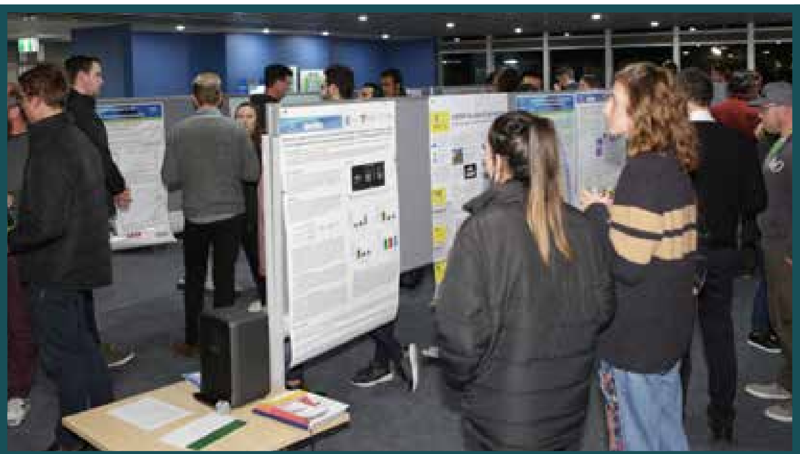
2018 AINSE WISE School Students

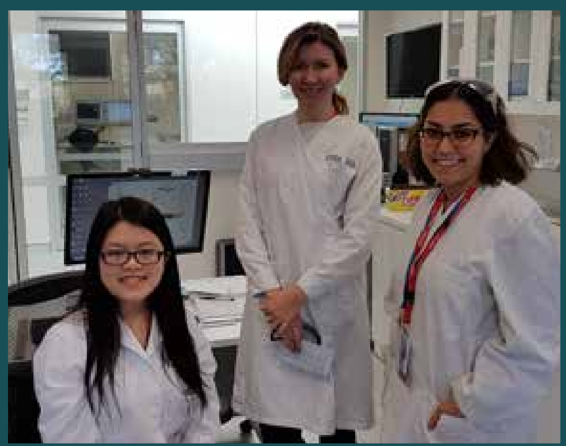
Karine Barclay	ECU	Emma Marchesan	USA
Olivia Bell	QUT	Nicole Martin	SWI
Kira Blankley	UWA	Archanaa N Chanthiran	QLD
Astrid Brorman	USC	Amber Nguyen	CUR
Annabelle Carrington	WAI	Leanni Nguyen	UWA
Chiara Cementon	ANU	Kali Notaras	CSU
Evelyn Charlesworth	CAN	Isobel Nutt	SCU
Dawnlicity Charls	NSW	Isabelle Ostrowski	MEL
Belinda Christensen	USC	Megan Palmer	MAS
Megan Clayton	ECU	Marissa Phoon	MON
Chelsea Dick	JAM	Jade Psychoulas	SCU
Ashlee Duff-Forbes	UNE	Cordelia Rentsch	SYD
Kaitlyn Eckermann	USA	Sukhmanmeet (Amy) Riar	USC
Kate Edwards	WAI	Isabella Riddell-Garner	VUW
Gemma Facchin	TAS	Emma Roberts	TAS
Ciara Flanagan	MON	Kyla Rutherford	RMI
Josephine Frazer	OTA	Georgina Ryan	MEL
Monique Garamy	ACU	Alicia Salvanos	ADE
Ariana Glass	CBR	Niamh Scott	CAN
Isabelle Gresser	UNE	Gabrielle Smith	CSU
Emma Hardwick	SCU	Fayliesha Spyker	UWA
Coco Huang	SYD	Gabrielle Stinton	CUR
Julia Kagiannis	MUR	Hope Tanudisastro	SYD
Amalia Kermond-Marino	MEL	Chelsea Trembath	DEA
Katherine Kinder	MAC	Kate Watson	QUT
Bianca Kirk	MAS	Eliza Watt	FLI
Judith Kull	ADE	Kirsten Wiedeman	ADE
Dominique Lubrin	NSW	Meg Willans	CUR
Zoe MacClure	OTA		

Student Disciplines / Areas of Study

Students attending the Women in STEM and Entrepreneurship School came from a diverse background of disciplines and areas of study, including the following:

Advanced Manufacturing	Environmental Science
Agricultural Science and Business	Food Science
Animal Science	Food Technology
Biological Engineering	Genetic Biology
Biology	Geology
Biomedical Engineering	Immunology
Biomedical Science	Law
Botany	Marine Science
Chemical Engineering	Mathematics
Chemical Physics	Mechanical Engineering
Chemical Processing	Medical Science
Chemistry	Metallurgical Engineering
Civil Engineering	Microbiology
Commerce	Molecular and Cell Biology
Computer Science	Nutrition
Computer Systems Engineering	Pharmaceutical Science
Conservation Biology	Pharmacology
Cyber Security	Physics
Earth Science	Physiology
Electrical Engineering	Physiology Science
Electronic and Robotic Engineering	Secondary Education
Environmental Engineering	





Winter School

Building networks across Australia and New Zealand, and between scientific generations

The AINSE Winter School is a week-long event held annually in July with two aims: to provide a bridge for undergraduate students to learn how nuclear science and engineering is used in their respective fields, and to create a network between students from universities across Australia and New Zealand that will continue throughout their future studies and research careers.

A range of facility-specific, hands-on sessions and tours provided students with a unique and immersive insight into the research performed at ANSTO's Sydney campus and the potential for further postgraduate opportunities across various research areas.

> *"Absolutely amazing, I would do it again in a heartbeat."*
>
> *- anonymous survey feedback, Winter School 2018*

Since 1997 the AINSE Winter School has successfully connected nuclear science and engineering with the broader scientific and engineering community, introduced undergraduate students to the possibilities of further academic research through ANSTO and AINSE, and established a basis for students to become future leaders in the fields of nuclear science and engineering.

In 2018, fifty-eight undergraduate students from forty-two member universities and organisations attended the 22nd AINSE Winter School in the first week of July.

The Winter School was opened on July 2 by Prof. Thomas Millar from Western Sydney University and AINSE President Prof. Claire Lenehan. Following a hands-on workshop on radiation safety delivered by the ANSTO Health Physics team, students were presented with a comprehensive overview of the work performed at ANSTO's landmark research infrastructure by leading ANSTO researchers through a series of insightful and engaging panel discussions.

Students also had the opportunity to hear from a range of high-profile guest speakers, including Dr. Ellen Moon from Deakin University and Dr. Barry Green from the University of Western Australia.

An active social program provided students with the opportunity to network with one another as well as various AINSE and ANSTO staff members, facilitating connections between students from across Australia and New Zealand and between future postgraduate students and established STEM professionals.

Students were provided with a project booklet and encouraged to discuss prospective projects with researchers during social events, including the Research Round-up networking dinner. Students were also informed of the different opportunities available from AINSE at different stages of their postgraduate journey.

ANSTO CEO Dr. Adi Paterson closed the Winter School with a presentation on his journey through undergraduate and postgraduate studies, and the important role that ANSTO continues to play in the advancement of nuclear science and engineering.

AINSE would like to thank all the guest speakers, laboratory supervisors, supporting staff and AINSE Councillors for their efforts in ensuring the success of the 2018 Winter School.

2018 AINSE Winter School Students

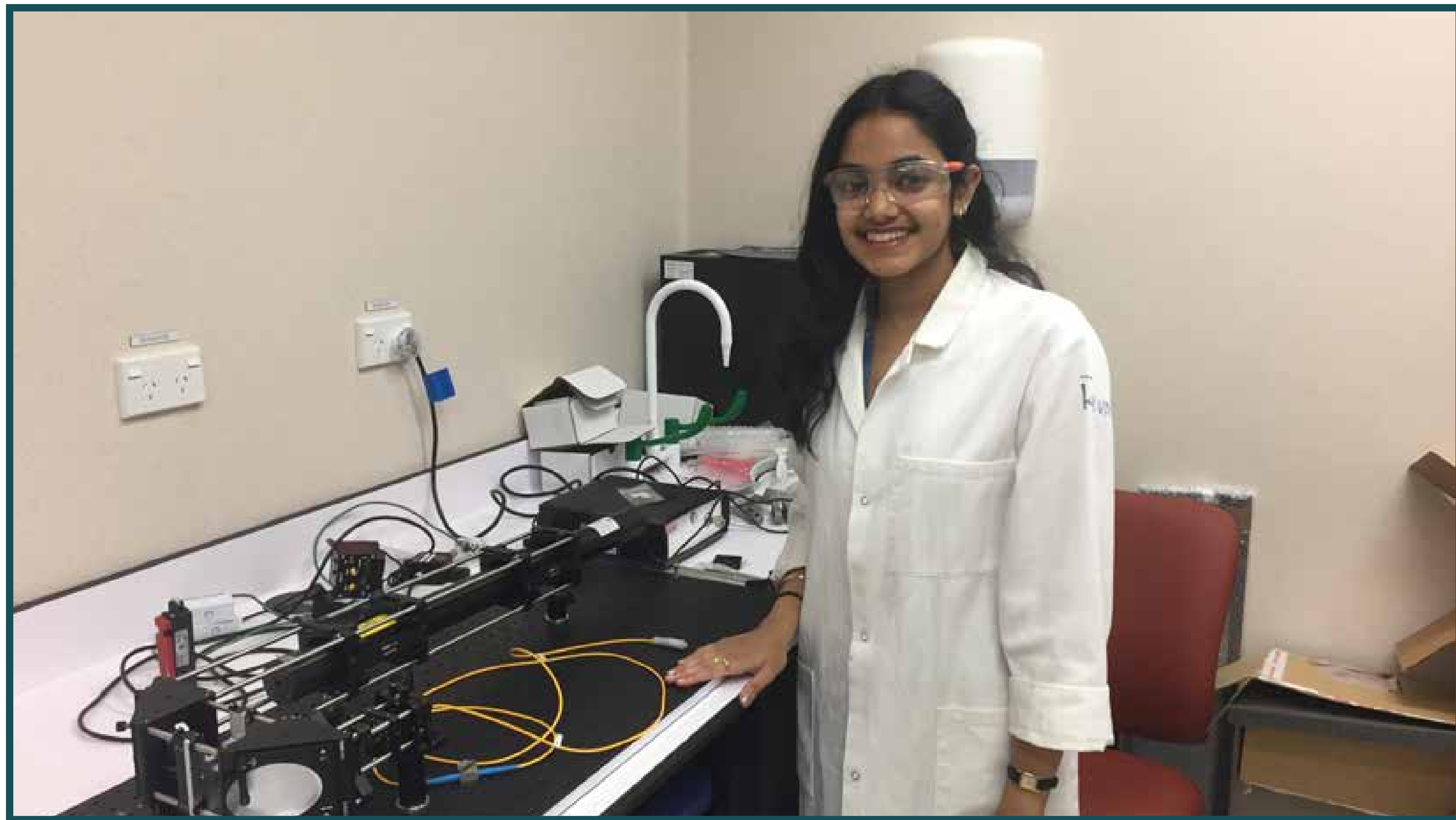
Rachel Baxter	OTA	George Kasongo	UNE
Joseph Behan	TAS	Shannon Kieran	CDU
Rachael Bell	RMI	Ke Ma	MON
Louis Bell	SCU	Rory McCallum	SWI
Sophie Brouwer	ECU	Bryce Mullens	SYD
Tane Butler	VUW	Zahra Saddat Naseri	WOL
Lillian Caruana	NSW	Christopher Nelson	QLD
Katherine Chea	RMI	Sarah Patterson	UTS
Yu-Hsien Chen	MEL	Iryna Paturi	CSU
Lisa Chen	MON	Oliver Paull	VAC
Keshav Curriman	MAC	Laura Penrose	OTA
Jacob Dalgeish	USA	Susheel Kumar Pirmani	DEA
Carl Andrew Dekker-Zangari	CUR	Ruby Roach	MAS
Bridget Duncan	ECU	Hayden Robertson	NCT
Rhys Eagle	UWA	Jacqueline Roe-Xin Yap	MEL
Jonathon Emerick	QLD	Steve Saliba	ACU
Taylor Farr	WAI	Dilys Sepe	CQU
Brittany Fitzalan	UWS	Lee Michael Shewchenko	USC
Garrick Foy	CDU	Kay Song	ANU
Peter Goodwin	ANU	Maiyurentheran Srikumar	MEL
Mitchell Gorman	FED	Neil Street	DST
Charlotte Groom	UWA	George Symonds	ADE
Rhona Hamilton	ADE	Aislinn Turner	WOL
Alex Hayes	FLI	Alejandro Vargas Uscategui	CSI
Charmaine Hee	THE	Claire Voogt	WAI
Michael James Hough	MUR	Owen Welsh	QLD
Erin Humphries	SYD	Zoe West	GRI
Prateek Jain	MON	Coen Wilson	LAT
Alysha Jones	AKL	Zhengshuai (Sean) Xu	QUT

Student Disciplines / Areas of Study

Students attending the Winter School came from a diverse background of disciplines and areas of study, including the following:

- Aerospace Engineering
- Analytical Chemistry
- Archaeology
- Biological Sciences
- Chemical Engineering
- Chemistry
- Civil Engineering
- Data Science
- Earth Science
- Education
- Electrical and Electronics Engineering
- Electronic and Communication Engineering
- Environmental Management
- Environmental Science
- Genetics
- Geology
- Geophysics
- Human Resource Management
- Marine Science
- Marine Science Management
- Materials Engineering
- Materials Science
- Mathematics
- Mechanical Engineering
- Medical Science
- Microbiology
- Nuclear Engineering
- Nuclear Physics
- Pathology
- Pharmaceutical Science
- Physical chemistry
- Physics
- Teaching
- Vulcanology

p. 82, top-left and top-right: students attending the Research Round-up networking dinner; centre: the 2018 Winter School alumni (photo credit: Bruce Hudson); bottom-left and bottom-right: students in ANSTO's Environmental Monitoring laboratories as part of the hands-on facility sessions; bottom-middle: ANSTO CEO Adi Paterson presentation certificates to students at the close of the Winter School.



Honours Scholarships

In 2018, AINSE continued its Honours program that first commenced in 2011. This program provides scholarships to a small number of excellent honours students who have a project that utilises the research facilities at ANSTO.

AINSE Honours Scholarships provide a stipend of A$5,000. Their purpose is to provide a link between the AINSE Winter School and other AINSE programs, such as the AINSE Postgraduate Research Award (PGRA).

AINSE wishes to congratulate the thirty-four successful students representing seventeen universities who were awarded an Honours Scholarship in 2018.

Honours students supported in 2018: **34**

Students supported through an AINSE Honours Scholarship since 2011: **149**

Honours Scholars, and Their Projects, awarded in 2018:

How do the Southern Hemisphere Westerly winds respond to rapid climate change? A case study of the Antarctic cold reversal from Tasmania.
Joseph Alexander, The University of Melbourne.

Exploring climate evolution through the glacial-interglacial cycle of Marine Isotope Stages 12 - 11 using lake sediments from Italy.
Sibel Ali-Zwart, The University of Melbourne.

Lanthanoid complexes as single molecule magnets.
Aiden Atkin, The University of Melbourne.

Reconstruction of the hydroclimate in the Cook Islands using speleothems.
Leilani Banerjee, University of Newcastle.

Green tea functionalised gold nanoparticles as radiosensitising agents for prostate cancer radiotherapy.
Jarryd Boath, RMIT University.

Development of new tau translational inhibitors for Alzheimers disease.
Paige Bromfield, University of Technology Sydney.

Structure and dynamics in photovoltaic metal hydrides.
Katherine Chea, RMIT University.

Investigating the interactions between Giant Unilamellar Vesicles (GUVs) and nanostructured surfaces.
Samuel Cheeseman,
Swinburne University of Technology.

Did climate change have an impact on the small vertebrates during the late Pleistocene?
Graeme Craig, Curtin University.

A Holocene paleoclimate record from a shallow lake in the drying Mediterranean-climate region of South-Western Australia.
Kaylene Craig, Curtin University.

Changes in protein structure on maturation of liquid protein droplets.
Alice Dix-Matthews,
The University of Western Australia.

The Broadbeach burial grounds.
Emma Dodd, The University of Queensland.

An investigation into the past environment of northeast Tasmania: A case study on Nicholas Swamp.
Amirah Farrell, The University of Queensland.

The expression of millennial-scale climate events in Southeast Australian speleothems.
Jay Gordon, The University of Melbourne.

The effect of moulting on contaminant regulation in decapod crustaceans.
Danielle Hill, Australian Catholic University.

The trophic structure of pelagic ecosystems in the Western Tasman Sea.
Lucas Kas, University of New South Wales.

New self-assembled monolayers for surface modification.
Anthony Katselas, The University of Sydney.

Decadal scale patterns of carbon accumulation and preservation in mangrove ecosystems.
Karen Lamont, Macquarie University.

Assessment of the creep damage in high temperature materials using novel microscopy and diffraction techniques.
Shir Ling Lim, The University of Sydney.

Assessing the effect of cold-work on the corrosion resistance of 316L stainless steel and Ni based superalloy.
Mia Maric, University of New South Wales.

The captain of the men of death: how does streptococcus pneumoniae cope with hydrogen peroxide?
Yanxiang Meng, University of Canterbury.

Controlling amphiphilic nanostructure in amino acid ionic liquid solution.
Shurui Miao, The University of Sydney.

Understanding 'diagnostic impact fractures': The validity and implications for future and current research.
Liam Neill, The University of Queensland.

The effects of bactericidal nanostructured surfaces on the attachment responses and proliferation of candida albicans.
Stephanie Owen, Swinburne University of Technology.

Quantification of thermal neutron fluence in high-energy LINAC radiotherapy for quality assurance and dose enhancement.
Vladimir Pan, University of Wollongong.

Integration of high-speed data acquisitisition systems for calibration of the SABRE scintillator.
Andrew Rowlands, Australian National University.

Trace element speciation and mobility in iron oxides.
Grace Scullett-Dean, The University of Queensland.

Effect of ultrafiltration and diafiltration at different temperatures on the structure of casein micelles in skim milk.
Ravnit Kaur Banwait Minderjit Singh,
University of Auckland.

Impacts of sewage overflows on ecosystem function in an estuarine lake.
Alessandra Suzzi, University of Newcastle.

Analysis of ferrocene.
Nicholas Tran, The University of Melbourne.

Preservation of fossils in an iron carbonate concretion.
Madison Tripp, Curtin University.

Quantitative analysis of radionuclide contamination surrounding Australian uranium mine sites.
William Tucker, Flinders University.

Late quaternary environment of Surrey Hills, North Tasmania.
Judith Vink, The University of Queensland.

Effects of ZnO nanoparticles on native marine amphipod allorchestes compressa: responses, localisation and uptake.
Sigrid Wilkens Flecknoe-Brown, RMIT University.

p. 85, clockwise from top: Preparing to study dissociation of casein micelles by EDTA (Ravnit Singh), porcelain arrows with impact fractures (Liam Neill), and an image of a protein crystal (Yanxiang Meng).

Facilitating world-class research and education across Australia and New Zealand

Student funding opportunities in 2019:

AINSE Postgraduate Research Awards (PGRA)

Up to A$7,500 per annum awarded as a top-up stipend for PhD students undertaking research associated with nuclear science and its applications. Includes fully-funded travel and accommodation to access ANSTO's research facilities.

Applications open: February 2019 – 15 April 2019

Residential Student Scholarship (RSS)

A top-up scholarship for students spending an extensive amount of their PhD time at ANSTO facilities. A$7,500 per annum stipend (pro rata where applicable).

Applications open: 16 April 2019 – 31 May 2019

Scholarship AINSE ANSTO French Embassy (SAAFE)

For PhD students and postgraduate researchers undertaking research collaborations between France and Australia in nuclear science and engineering. Up to A$15,000 is provided towards travel and/or accommodation expenses in France or Australia.

Applications open: November 2018 – 1 May 2019

AINSE Early Career Researcher Grant (ECRG)

A grant of A$10,000 to support early-career researchers working in collaboration with ANSTO.

Coming soon in 2019.

AINSE Honours Scholarships

A stipend of A$5,000 to support Honours (or Honours-equivalent) students undertaking research at ANSTO or processing data collected from ANSTO facilities.

Applications open: December 2019 – 15 February 2020

Conference Travel Support

For student travel to domestic or international conferences at which the student will be presenting.

Applications open: year-round

AINSE Events Calendar for 2019:

AINSE Winter School (July 8-12)

For senior undergraduate STEM students.

Go hands-on with Australian landmark research infrastructure, guided by leading ANSTO researchers, at an intensive week-long Winter School at ANSTO's Sydney campus. Flights, meals and accommodation included.

Applications open: March 2019 – 15 May 2019.

AINSE Postgraduate Orientation Week (October 14–16)

For AINSE honours & postgraduate scholarship recipients.

Network with fellow early-career researchers from across Australia and New Zealand, meet your project co-supervisors and take general and site-specific tours of the facilities at ANSTO's Sydney campus. Flights, meals and accommodation included.

Open to all Honours, PGRA, RSS and SAAFE recipients.

AINSE Women in STEM and Entrepreneurship (WISE) School (December 3–6)

For first-year female undergraduate STEM students.

Travel to ANSTO's Sydney campus to meet established researchers and entrpreneurs, network with fellow first-year students from across Australia and New Zealand, and engage in a year-long mentorship program with AINSE and ANSTO staff. Flights, meals and accommodation included.

Applications open: September 2019 – 8 November 2019.

Visit ainse.edu.au to see other AINSE-supported events and conferences in 2019.

AINSE

The Australian Institute of Nuclear Science and Engineering

New Illawarra Road, Lucas Heights NSW 2234 Australia

+61 2 9717 3376 | ainse@ainse.edu.au | www.ainse.edu.au

ABN 18 133 225 331

AINSE Ltd.

PGRA Scholarships

Postgraduate Research Award

An AINSE Postgraduate Research Award (PGRA) is a top-up scholarship. To be eligible for one of these awards, an applicant must hold an Australian Government Research Training Program scholarship (AGRTP or RTP) or equivalent scholarship. The PGRA may be held until the expiry of the primary scholarship.

In addition to providing a student with a stipend of A$7,500 per annum, the award provides access to ANSTO's world-class facilities and expertise. An allowance for travel expenses for two visits and a total of one month's accommodation to Lucas Heights per annum is also awarded.

Thirty-one new AINSE postgraduate research projects were supported by a PGRA in 2018. The total number of scholars supported in 2018 was eighty-seven. AINSE received sixteen theses this year and, through its PGRA program, has now helped train four hundred and twenty students in aspects of nuclear science and associated techniques of analysis. Many more students have been assisted with their research by gaining access to Lucas Heights facilities through AINSE Awards granted to their supervisors.

The Council believes that one of the most valuable roles fulfilled by AINSE is the provision of these scholarships.

PGRA students supported in 2018: **87**

New PGRA students in 2018: **31**

Students trained in nuclear science and related fields under an AINSE PGRA: **420**

PhD Theses of Postgraduate Scholars received during 2018:

TiO2-based semiconductors for solar energy conversion with a focus on Ta-doped TiO2.
Mohammad Alim, Solar Energy Technologies, Western Sydney University.
Commenced 01/07/2016.

Hybrid ion-exchange membrane-electrode for advanced catalysis and desalination processes.
Francois-Marie Allioux, Institute for Frontier Materials, Deakin University.
Commenced 01/07/2015.

Stretchable and self-healing conducting polymers for organic electronics.
Paul Baek, School of Chemical Science, The University of Auckland.
Commenced 01/07/2014.

Materials for the next generation of batteries.
James Christian, Chemistry, The University of New South Wales.
Commenced 01/07/2015.

Designed polymer-based nanoparticles for drug delivery and imaging.
Lars Esser, Monash Institute of Phamaceutical Sciences, Monash University.
Commenced 01/07/2014.

Addressing current limitations in the synthesis of dicarba peptides.
Ellen Gleeson, Chemistry, Monash University.
Commenced 01/07/2014.

Tackling polymyxin resistance in pseudomonas aeruginosa: A multi-disciplinary approach.
Meiling Han, Monash Institute of Phamaceutical Sciences, Monash University.
Commenced 01/07/2016.

Palaeofire activity in Western Tasmania: Climate drivers and land-cover changes.
Michela Mariani, School of Geography, The University of Melbourne.
Commenced 01/07/2016.

Surfactant mediated control of aqueous graphene oxide dispersions.
Thomas McCoy, School of Chemistry, Monash University.
Commenced 01/07/2016.

Inter-aquifer connectivity: investigating groundwater movement through a regional-scale aquitard using a multi-scale and multi-tracer approach.
Stacey Priestley, School of the Environment, Flinders University.
Commenced 01/07/2014.

Multiscale characterisation of reduced graphene oxide assemblies.
Ashley Roberts, Materials Engineering, Monash University.
Commenced 01/07/2014.

Corrosion of structural alloys in molten salts for solar thermal energy storage.
Madjid Sarvghad Moghaddam, Chemistry, Physics and Mechanical Engineering School, Queensland University of Technology.
Commenced 01/07/2016.

Low oxidation state heavy p-block metal compounds supported by di(amido) chelating ligands.
Ryan Schwamm, School of Chemical and Physical Sciences, Victoria University of Wellington.
Commenced 01/07/2015.

Advancement in speleothems petrography and microstratigraphy as proxies of climate and environmental changes.
Valentina Vanghi, School of Environmental & Life Sciences, The University of Newcastle.
Commenced 01/07/2016.

Structure-function relationships in metal hydrides: origin of pressure hysteresis.
Timothy Webb, Queensland Micro-and Nanotechnology Centre, Griffith University.
Commenced 01/07/2012.

The hydro-geomorphic structure, function and evolution of chains-of-ponds: Implications for recognition of these discontinuous watercourses in river management.
Rory Williams, Environment & Geography, Macquarie University.
Commenced 01/07/2014.

Research Highlights:

Michela Mariani - page 17

Palaeofire activity in Western Tasmania: Climate drivers and land-cover changes.

Meiling Han - page 25

Tackling polymyxin resistance in pseudomonas aeruginosa: A multi-disciplinary approach.

Thomas McCoy - page 34

Surfactant mediated control of aqueous graphene oxide dispersions.

p.89, clockwise from top: investigating the effects of contaminated sediment at the National Sea Simulator, Townsville (Francesca Gissi, far right), collecting samples from Mt. Taranaki (Geoffrey Lerner), and loading samples at the Australian Synchrotron SAXS/WAXS beamline (Emma Livingstone).

Postgraduate Scholars, and Their Projects, supported in 2018:

When was the Antarctic landscape last unfrozen?
Jacob Anderson, Marine Science,
University of Otago .
Commenced 01/07/2017.

Calibration of advanced hydrologic and isotopic palaeoclimate models with lake monitoring.
Martin Ankor, School of Physical Sciences,
The University of Adelaide.
Commenced 01/07/2016.

Far and mid-infrared spectroscopy of astrochemical species and aerosols.
Rebecca Auchettl, Chemistry and Physics,
La Trobe University.
Commenced 01/07/2017.

The impact of ionizing radiation on the central nervous system.
Calina Betlazar-Maseh, Faculty of Health Sciences,
The University of Sydney.
Commenced 01/07/2017.

Characterisation and evolution of Rottnest Island salt lake microbialites, Western Australia.
Karl Bischoff, Earth Sciences,
The University of Western Australia.
Commenced 01/07/2017.

The use of BiNSAIDs as novel chemopreventive agents for colorectal cancer.
Tara Brown, School of Chemistry,
University of Wollongong.
Commenced 01/07/2017.

Pre-treatment of biomass and dissolution of (bio) polymers using choline amino acid ionic liquids.
Manuel Brunner, School of Molecular Sciences,
The University of Western Australia.
Commenced 01/07/2018.

Exploring magnetoelectric coupling in ferroics; neutron scattering experiments probing the magnetic phases of BiFeO3.
Stuart Burns, School of Materials Science and Engineering, The University of New South Wales.
Commenced 01/07/2016.

Characterisation of pregnancy zone protein-cytokine interactions by autoradiography.
Jordan Carter, Biological Sciences,
University of Wollongong.
Commenced 01/07/2017.

Functional magnetic interface phenomena in nano-architectures studied by polarised neutron reflectometry.
Grace Causer, Institute for Superconducting and Electronic Materials, University of Wollongong.
Commenced 01/07/2016.

Landscape evolution of the Kimberley region and rock art dating using cosmogenic ^{10}Be and ^{26}Al.
Gael Cazes, School of Earth and Environmental Sciences, University of Wollongong.
Commenced 01/07/2016.

Characterizing insect odorant receptors on electropolymerized conducting polymer thin films for odorant sensing.
Jamal Cheema, School of Chemical Sciences,
The University of Auckland .
Commenced 01/07/2018.

Diffusion in solid ionic conductors for sodium-ion battery applications: structure and dynamics.
Emily Cheung, School of Chemistry,
The University of New South Wales.
Commenced 01/07/2017.

Blast survivability of a fatigued naval surface platform.
Daniel Clayton, Australian Maritime College,
University of Tasmania.
Commenced 01/07/2018.

Sulphur: a new proxy for wildfire in speleothem records.
Katie Coleborn, Biological, Earth and Environmental Sciences, The University of New South Wales.
Commenced 01/07/2017.

The interfacial structure and composition of an ionic liquid lubricant additive.
Peter Cooper, Engineering,
The University of Western Australia.
Commenced 01/07/2017.

Examining the structure and function of mixed lineage kinase-domain like protein: the final executioner of necroptosis.
Katherine Davies, Medical Biology,
The University of Melbourne.
Commenced 01/07/2017.

Crystal field excitations and exchange coupling in lanthanoid complexes by inelastic neutron scattering.
Maja Dunstan, School of Chemistry,
The University of Melbourne.
Commenced 01/07/2018.

Uncovering the mechanisms of corrosion-resistant materials: towards developments of novel corrosion inhibition measures.
Deepak Dwivedi, Chemical Engineering,
Curtin University of Technology.
Commenced 01/07/2017.

Radiocarbon age of dissolved organic carbon under contrasting land uses in NSW Australia.
Rubeca Fancy, School of Environmental & Rural Science, The University of New England.
Commenced 01/07/2016.

Unlocking the Kimberley's environmental past: late quaternary multi-proxy analysis of tropical mound spring peat cores.
Emily Field, Geography, Planning and Environmental Management, The University of Queensland.
Commenced 01/07/2015.

Radiocarbon dating of Kimberley rock art.
Damien Finch, School of Earth Sciences,
The University of Melbourne.
Commenced 01/07/2016.

Stable carbon isotope analysis of Pandanus sp. drupes: a proxy for ancient foraging practices at Madjedbebe (Malakunanja II).
Stephanie Florin, Social Sciences,
The University of Queensland.
Commenced 01/07/2015.

A breath of fresh air for cystic fibrosis.
Melanie Fuller, School of Chemical and Physical Sciences, Flinders University.
Commenced 01/07/2016.

Using Casuarina cunninghamiana as a record of floodplain deposition with C-14, Itrax, and radium isotopes.
Jonathan Garber, School of Geography,
The University of Melbourne.
Commenced 01/07/2018.

Structures and properties of newly synthesised layered metal chalcogenides.
Conrad Gillard, School of Chemistry,
The University of New South Wales.
Commenced 01/07/2018.

Reconstructing the post-glacial history of the subantarctic Auckland Islands from marine sediment cores using ITRAX XRF and AMS radiocarbon.
Greer Gilmer, Geological Sciences,
University of Otago.
Commenced 01/07/2015.

Unravelling the complex relationship of the coral holobiont and its responses to metal contaminants.
Francesca Gissi, School of Chemistry,
University of Wollongong / CSIRO.
Commenced 01/07/2016.

Interactions between meteoric, surface and ground water in fractured rock: Upper Murrumbidgee catchment.
Sharon Gray, Research School of Earth Sciences,
The Australian National University.
Commenced 01/07/2016.

Experimental demonstration of Bragg-edge neutron strain tomography.
Alexander Gregg, School of Engineering,
The University of Newcastle.
Commenced 01/07/2017.

Toward smarter surfaces: exploring the selectivity and stimuli-response available through polymer brushes.
Isaac Gresham, Chemical Sciences,
The University of New South Wales.
Commenced 01/07/2017.

Structural and functional characterisations of the CCC protein family.
Michael Healy, Institute for Molecular Bioscience,
The University of Queensland.
Commenced 01/07/2018.

Synthesis of Carbon-11 and Fluorine-18 PET radiotracers for targeting the NOD-like receptor Protein 3 (NLRP3) - a key bio-marker of neurodegenerative inflammation.
James Hill, Institute for Molecular Bioscience,
The University of Queensland.
Commenced 01/07/2018.

Quantifying anthropogenic impacts on dust flux and its interaction with recipient ecosystems.
James Hooper, School of Earth & Environmental Sciences, University of Wollongong.
Commenced 01/07/2016.

Research Highlights:

Gael Cazes - page 8

Landscape evolution of the Kimberley region and rock art dating using cosmogenic ^{10}Be and ^{26}Al.

Melanie Fuller - page 23

A breath of fresh air for cystic fibrosis.

James Hooper - page 11

Quantifying anthropogenic impacts on dust flux and its interaction with recipient ecosystems.

Molecular recognition using cage-like Iron(II) spin-crossover materials; utilising neutron scattering to investigate host-guest properties.
Kyle Howard-Smith, School of Science and Health, Western Sydney University.
Commenced 01/07/2018.

Confinement effects on the stimulus response of polymer brushes.
Ben Humphreys, Chemistry, The University of Newcastle.
Commenced 01/07/2016.

Interdecadal ENSO variability in the past millennium: the role of coupled air-sea interactions in the central Pacific.
Jasmine Hunter, School of Earth Sciences & Environmental Sciences, University of Wollongong.
Commenced 01/07/2017.

Using atmospheric and plant-based sampling of C-14 to constrain local and regional fossil fuel emissions.
Wenwen Huo, School of Earth Sciences, The University of Melbourne.
Commenced 01/07/2016.

Antarctic ice-shelf stability and collapse: a geochemical history of Antarctic Peninsula ice-shelves.
Matthew Jeromson, Institute for Applied Ecology, University of Canberra.
Commenced 01/07/2018.

Synthesis and characterisation of multi-stimuli responsive polymer brushes.
Edwin Johnson, Chemistry, The University of Newcastle.
Commenced 01/07/2017.

Mineral controls on soil carbon stability along the subtropical giant podzol Cooloola chronosequence.
Andrew Jones, School of Agriculture and Food Science, The University of Queensland.
Commenced 01/07/2015.

Search for novel multiferroic materials: A comprehensive synchrotron and neutron diffraction study on magnetite (Fe_3O_4).
Yousef Kareri, Physics, The University of New South Wales.
Commenced 01/07/2017.

Development of nanosensors for Reactive Oxygen Species (ROS) detection in impact of radiation and radiotherapy.
Jagjit Kaur, Biomedical Engineering, The University of New South Wales.
Commenced 01/07/2018.

Hydrogen depth profiling of high strength steels.
Oluwole Kazum, Chemical Engineering, James Cook University.
Commenced 01/07/2015.

Nanoplastic waste: exploring the damage nanoplastics cause to biological systems at nanoscale using neutron scattering.
Shinji Kihara, School of Chemical Sciences, The University of Auckland .
Commenced 01/07/2018.

Tomographic imaging of residual elastic strain fields in whole components via strain tomography.
Henry Kirkwood, Chemistry and Physics, La Trobe University.
Commenced 01/07/2015.

Synthesis and photophysics of metal-Fluorine(18) radiopharmaceutical complexes as optical-positron emission multimodal diagnostic agents.
Mitchell Klenner, Chemistry, Curtin University of Technology.
Commenced 01/07/2015.

Southern Hemisphere westerly wind changes in Late Glacial to Early Holocene Fiordland.
Cara Lembo, Geology, University of Otago .
Commenced 01/07/2018.

Developing a spatio-temporal model for mass flow hazards at stratovolcanoes, Mt. Taranaki, New Zealand.
Geoffrey Lerner, School of Environment, The University of Auckland .
Commenced 01/07/2016.

Evaluation of 3D graphene scaffold for in vivo biocompatibility and its role in promoting bone regeneration.
Jianfeng Li, Intelligent Polymer Research Institute, University of Wollongong.
Commenced 01/07/2018.

Interplay between doping and mechanistic behavior of a high-voltage spinel positive electrode for lithium-ion batteries.
Gemeng Liang, Institute for Superconducting & Electronic Materials, University of Wollongong.
Commenced 01/07/2018.

A combined in situ electron microscopy and neutron scattering study of "honeycomb" layered oxides as sodium ion battery electrodes.
Jiatu Liu, School of Chemistry, The University of Sydney.
Commenced 01/07/2018.

Structural investigation of the Munc18:SNARE protein complexes required for neurotransmission and blood glucose control.
Emma Livingstone, Institute for Molecular Bioscience, The University of Queensland.
Commenced 01/07/2016.

Inorganic nanoparticles/metal organic frameworks hybrid membrane reactors for simultaneous separation and conversion of CO_2.
James Maina, Institute for Frontier Materials, Deakin University.
Commenced 01/07/2016.

Probing the relationship between the structural and rheological properties of liquid crystals using scattering and fluorescence techniques.
Joshua Marlow, School of Chemistry, Monash University.
Commenced 01/07/2018.

Southeast Australian palaeofloras of the past 100,000 years, and their implications for palaeoclimate reconstructions.
Kia Matley, School of Biosciences, The University of Melbourne.
Commenced 01/07/2018.

Metal pollution during pulse storm events: accumulation kinetics and effects in a freshwater decapod crustacean.
Sarah McDonald, School of Biosciences, The University of Melbourne.
Commenced 01/07/2018.

Evolution and sedimentary architecture of Halimeda bioherms in the Great Barrier Reef: understanding origin, development, morphology, and palaeo-environment.
Mardi McNeil, School of Earth, Environmental and Biological Science, Queensland University of Technology.
Commenced 01/07/2017.

Understanding the co-precipitation mechanisms of $Al_3(Sc,Zr)$ with Li-containing phases in Al-Cu-Li model alloys.
Anne Mester, Institute for Frontier Materials, Deakin University.
Commenced 01/07/2017.

Early stage cancer diagnosis: SANS characterization of antigen-nanocubes (Au-NPFe_2O_3NC) interactions for the detection of p53 autoantibodies.
Masud Mostafa Kamal, Institute for Superconducting & Electronic Materials, The University of Queensland.
Commenced 01/07/2018.

A fundamental and systematic investigation of actinide (uranium and thorium) containing materials related to the nuclear fuel cycle.
Gabriel Murphy, Chemistry, The University of Sydney.
Commenced 01/07/2017.

Investigating transfer and accumulation of trace metals up the food chain: using radiotracers to observe the uptake of contaminants in prawns and fish from seawater and dietary ingestion.
Kaitlyn O'Mara, Australian Rivers Institute, Griffith University.
Commenced 01/07/2016.

Examination of radionuclide uptake by flora in the arid environment surrounding the Olympic Dam Cu-U-Au-Ag mine in South Australia.
Samantha Pandelus, College of Science and Engineering, Flinders University.
Commenced 01/07/2018.

Interfacial magnetism effects and multiferroic thin films for device applications.
Oliver Paull, Institute of Superconduction & Electronic Materials, The University of New South Wales.
Commenced 01/07/2017.

Chronology development of Auckland Maar Lake sediment records.
Leonie Peti, School of Environment, The University of Auckland .
Commenced 01/07/2017.

Research Highlights:

Andrew Jones - page 14

Mineral controls on soil carbon stability along the subtropical giant podzol Cooloola chronosequence.

Mitchell Klenner - page 28

Synthesis and photophysics of metal-Fluorine(18) radiopharmaceutical complexes as optical-positron emission multimodal diagnostic agents.

Kaitlyn O'Mara - page 20

Investigating transfer and accumulation of trace metals up the food chain: using radiotracers to observe the uptake of contaminants in prawns and fish from seawater and dietary ingestion.

Exploring the potential of Mg/Ca ratios in sub-aqueous speleothems to reconstruct surface temperatures over multiple glacial-interglacial cycles.
Timothy Pollard, School of Geography,
The University of Melbourne.
Commenced 01/07/2017.

Characterisation of organic electronic components for dosimetry in radiotherapy.
Jessie Posar, School of Physics,
University of Wollongong.
Commenced 01/07/2018.

Fire and environmental change in Northern Australia during the Late Holocene.
Emma Rehn, Science and Engineering,
James Cook University.
Commenced 01/07/2017.

Radiocarbon and cryptotephra in the Australian tropical savannas: a case study from Sanemere Lagoon, northeast Australia.
Maria Jose Rivera Araya, College of Science and Engineering, James Cook University.
Commenced 01/07/2018.

Investigating sustainable management of marine resources over five centuries on Molokai, Hawaiian Islands.
Ashleigh Rogers, School of Social Science,
The University of Queensland.
Commenced 01/07/2018.

Elucidating carbon sources in groundwater ecosystems via radiocarbon and stable isotope analysis.
Mattia Sacco, Applied Geology,
Curtin University of Technology.
Commenced 01/07/2017.

Using C-14 to resolve mangrove carbon cycling.
James Sippo, Centre for Coastal Biogeochemistry,
Southern Cross University.
Commenced 01/07/2016.

Sourcing historical contamination in the Gippsland Lakes, Victoria.
Adam Trewarn, Applied and Biomedical Science,
Federation University Australia.
Commenced 01/07/2015.

Investigating the architecture of rice starch at the nanoscale using complementary scattering methods to predict digestibility.
Matthew Van Leeuwen, School of Science and Health,
Western Sydney University.
Commenced 01/07/2017.

Formation of a stable long range magnetic skyrmion lattice in thin films of the room temperature chiral material Co8Zn8Mn4.
Gaurav Vats, School of Materials Science and Engineering, The University of New South Wales.
Commenced 01/07/2018.

Towards personalised therapy: [64Cu]CuCl2 PET/CT imaging to determine acquired platinum drug resistance, and to monitor the treatment response in neuroblastoma.
Florida Voli, School of Women's and Childre's Health,
The University of New South Wales.
Commenced 01/07/2018.

Investigating the homogeneity, thickness and fouling resistance of the plasma-synthesized polymer blend thin films for low-cost desalination.
Jingshi Wang, Institute for Frontier Materials,
Deakin University.
Commenced 01/07/2018.

Using ITRAX XRF, multi-dimensional isotope analysis and silica microfossils to study the palaeo-ecology of sclerophyll sites in the Atherton Tablelands, northeastern Australia.
Loraine Watson-Fox, Geography, Planning & Environmental Management,
The University of Queensland.
Commenced 01/07/2016.

Iron isotope geochemistry of jarosite and implications for iron cycling in sediments on Earth and Mars.
Anne Whitworth, School of Earth, Atmosphere and Environment, Monash University.
Commenced 01/07/2018.

Novel fluorinated radioligands of the tyrosine kinase, MERTK, for imaging and diagnosis in multiple sclerosis.
Siu Wai Wong, Monash Institute of Pharmaceutical Sciences, Monash University.
Commenced 01/07/2016.

Operando X-ray absorption spectroscopy study of sodium storage mechanism of ZnXP2 (X=Sn, Ge or Si) anodes.
Zhibin Wu, Institute of Superconduction & Electronic Materials, University of Wollongong.
Commenced 01/07/2017.

Formation and investigation of polymeric nanocapsules with high aspect ratio via vesicle templation with RAFT polymerisation and their interactions with cells.
Yunxin Xiao, Monash Institute of Pharmaceutical Sciences, Monash University.
Commenced 01/07/2018.

Detailed investigation of factors affecting the formation of intermediate phase during dehydroxylation of serpentine minerals.
Sana Zahid, School of Engineering,
Murdoch University.
Commenced 01/07/2017.

Variable temperature studies on spin crossover materials to model guest rearrangement and molecular rotations.
Katrina Zenere, Chemistry,
The University of Sydney.
Commenced 01/07/2017.

Ion irradiation on multilayered oxide heterostructure with possible topological properties.
Jiali Zeng, School of Materials Science and Engineering, The University of New South Wales.
Commenced 01/07/2018.

Synthesis, radiolabelling and bio-conjugation studies of [18F]ethenesulfonyl fluoride (ESF) - a new innovative tool for radiopharmaceutical development.
Bo Zhang, School of Chemistry,
Monash University.
Commenced 01/07/2016.

Electrostatic effects on chemical reactivity; oriented double layer effects on chemical bonding kinetics and thermodynamics.
Long Zhang, Intelligent Polymer Research Institute,
University of Wollongong.
Commenced 01/07/2016.

Research Highlights:

Bo Zhang - page 32

Synthesis, radiolabelling and bio-conjugation studies of [18F]ethenesulfonyl fluoride (ESF) - a new innovative tool for radiopharmaceutical development.

Long Zhang - page 37

Electrostatic effects on chemical reactivity; oriented double layer effects on chemical bonding kinetics and thermodynamics.

PGRA Orientation Week

AINSE were delighted to welcome twenty-two new Postgraduate Research Award (PGRA) students to our annual Orientation Week at ANSTO's Sydney campus from October 15-17.

Over the course of the week, students attended a number of expert panel sessions hosted by leading ANSTO researchers. These sessions provided a detailed introduction to ongoing ANSTO research projects in the areas of Environment, Health, and the Nuclear Fuel Cycle, as well as the landmark research infrastructure facilitating ANSTO's research outcomes.

Following these panel sessions, students had the opportunity to tour a selection of ANSTO's research infrastructure, including the OPAL Multipurpose Reactor and Australian Centre for Neutron Scattering. ANSTO co-supervisors met with the students to provide site-specific introductions to their individual research areas.

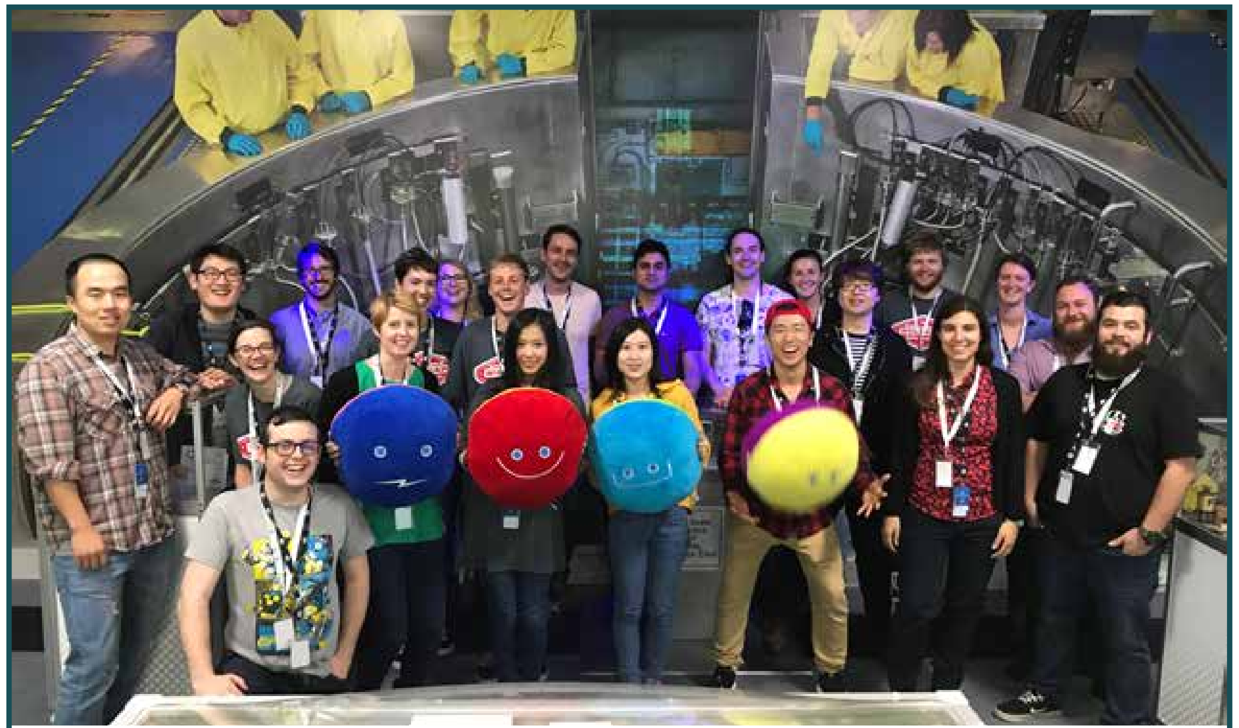
The program coincided with Nuclear Science Week, an international celebration of nuclear science. AINSE coordinated with the Australian Young Generation in Nuclear (AusYGN), the Women in Nuclear (WiN) Australia chapter, and the National Museum of Nuclear Science and History in Albuquerque to deliver a series of social events in celebration of Nuclear Science Week. Students were able to network with representatives from AusYGN and WiN, as well as Dr. Adi Paterson, CEO of ANSTO. Dr. Paterson gave an inspiring talk on the crucial role our early-career researchers will play in shaping the culture of STEM workplaces.

The program concluded with presentations by AINSE Managing Director Michelle Durant and PGRA student Francesca Gissi , who shared their research journeys with the students and provided insightful advice for succeeding in postgraduate studies.

AINSE would like to thank ANSTO, AusYGN and WiN for their support in making the event a success. We wish our new PGRA scholars all the best with their research endeavours.

Students celebrating Nuclear Science Week.

Dr. Miles Apperley, Head of Research Infrastructure at ANSTO, providing an overview of ANSTO's research facilities.



The new cohort of AINSE PGRA scholars who attended the PGRA Orientation Week.

2018 AINSE PGRA Orientation Week Attendees

Manuel Brunner	UWA	Joshua Marlow	MON
Daniel Clayton	TAS	Mostafa Kamal Masud	QLD
Maja Dunstan	MEL	Kia Matley	MEL
Jonathan Garber	MEL	Sarah McDonald	MEL
Conrad Gillard	NSW	Samantha Pandelus	FLI
Michael Healy	QLD	Maria Jose Rivera Araya	JAM
Kyle Howard-Smith	UWS	Florida Voli	NSW
Matthew Jeromson	CBR	Jingshi Wang	DEA
Jianfeng Li	WOL	Anne Whitworth	MON
Gemeng Liang	WOL	Yunxin Xiao	MON
Jiatu Liu	SYD	Jiali Zeng	NSW

ANSTO CEO Dr. Adi Paterson addresses the new PGRA students at a networking dinner.

Residential Student Scholarships

In 2018 AINSE continued to offer the Residential Student Scholarship (RSS), which is a 'top-up' residential postgraduate scholarship to high-quality students who are enrolled in a PhD at an AINSE Member University. The RSS differs from a Postgraduate Research Award (PGRA) in that a RSS student must be onsite at an ANSTO facility (at Lucas Heights, Camperdown and/or Clayton) for six months per year, which can be a single block of time or separate visitations. The award was developed as AINSE recognised an opportunity to support students whose project topics closely align with ANSTO's research programmes; The Environment, Human Health, Nuclear Fuel Cycle, Defence Industry and Fusion.

AINSE wishes to congratulate the successful RSS applicants for 2018 (listed below), who have secured a $7,500 (pro rata where applicable) stipend per annum with up to $5,000 travel and accommodation allowance per annum.

Residential Scholars, and Their Projects, awarded in 2018:

Environmental history of the Arthur's Pass area, South Island, New Zealand since the last Glacial maximum.
Patrick Adams, The University of Queensland.

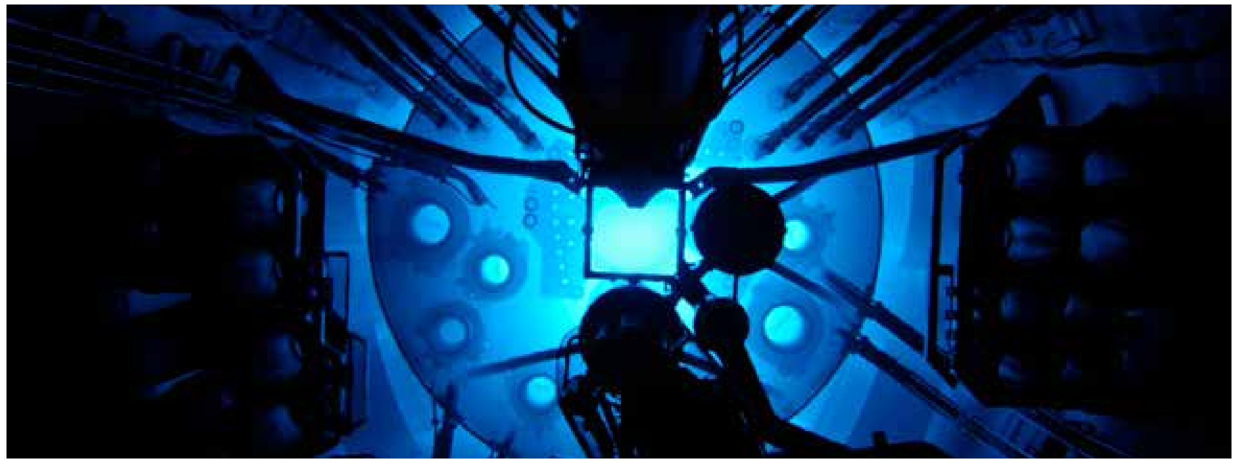
Properties of urania zirconia mixed oxides by Sol gel synthesis.
Dillon Frost, The University of New South Wales.

Hydrogen storage performance of additively manufactured TiFe and TiAl intermetallics.
Sujan Ghosh, University of Wollongong.

Development of scientifically robust analytical tools for seafood provenance and quality authentication.
Karthik Gopi, The University of New South Wales.

In-situ micromechanical investigation of ion-irradiated high entropy alloys.
Michael Moschetti,
The University of New South Wales.

Dose quantification in heavy ion therapy using positron emission tomography.
Harley Rutherford, University of Wollongong.



The interior of ANSTO's OPAL Multipurpose Reactor, illuminated by Cherenkov radiation. Photo credit: ANSTO.

Scholarship AINSE/ANSTO/ French Embassy (SAAFE)

As a result of the MOU signed between AINSE, ANSTO and the Embassy of France in Australia in 2017, four PhD students were approved to travel either from Australia to France or from France to Australia as part of the second round of the Scholarship AINSE ANSTO French Embassy (SAAFE) research internship program in 2018.

The SAAFE Program facilitates the conduct of research and fosters research collaborations between France and Australia in nuclear science and engineering. The program supports early careers researchers at the PhD level to expand research and innovation activities within the research areas of Human Health, the Environment and the Nuclear Fuel Cycle, and to initiate sustainable research networks and linkages to support Australia and France in research and innovation.

The SAAFE students who travelled internationally in 2018 were Gabriel Murphy from the University of Sydney, who was hosted by Centralesupelec University, and Izabella Zahradnik from CEA-LIST Diamond Sensors Laboratory in France, who undertook research with ANSTO and the University of Wollongong.

AINSE is thankful for the support offered by the Embassy of France in Australia and ANSTO to enable this wonderful overseas internship opportunity.

SAAFE Scholars awarded in 2018:

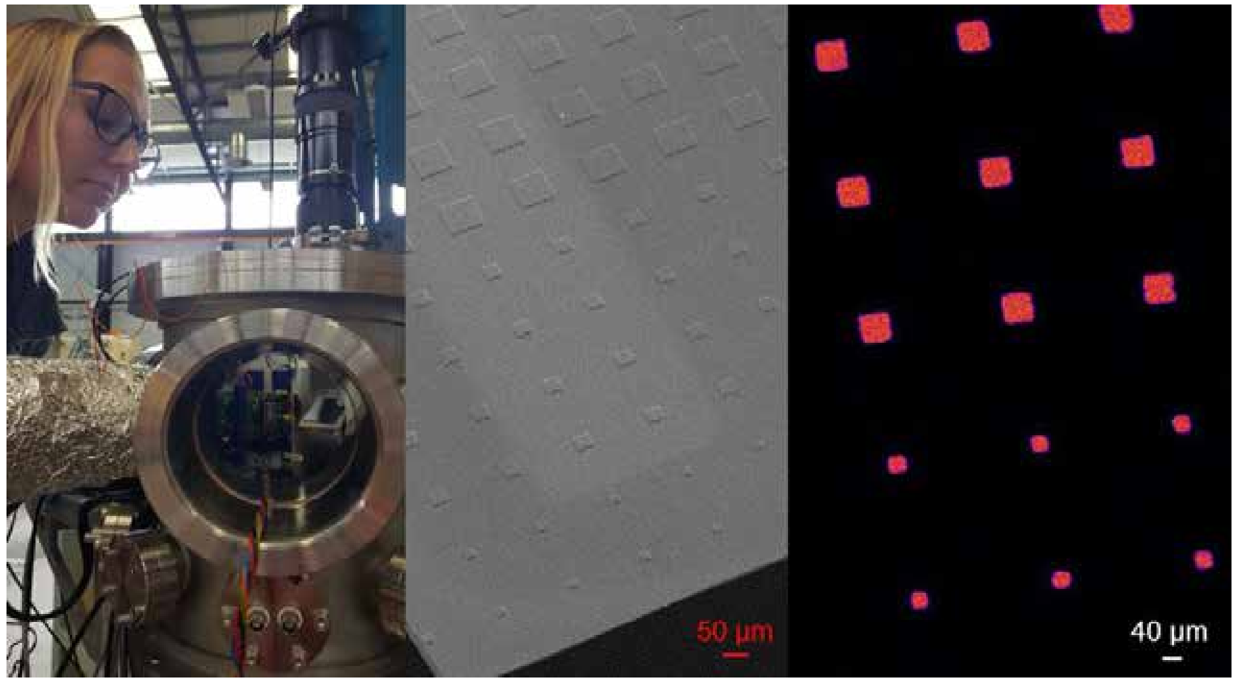
STUDENT	UNIVERSITY OF ENROLMENT	HOST INSTITUTION(S)
Jean Goder	École Normale Superieure de Paris (FRA)	RMIT University (AUS)
Denver Linklater	Swinburne University of Technology (AUS)	Université Grenoble-Alpes (FRA)
Oswald Malcles	Université de Montpellier (FRA)	ANSTO (AUS)
Izabella Zahradnik	Université Paris Saclay (FRA)	Univeristy of Wollongong (AUS) ANSTO (AUS)

SAAFE Report from Izabella Zharadnik

Hadron therapy, or the use of protons or carbon ions, is an innovative type of radiotherapy for cancer treatment that enables tumor cells to be more effectively destroyed than conventional radiotherapy (RT) using photons.

2018 SAAFE Scholar Izabella Zharadnik

The precise knowledge of the energy deposited by a single event in sensitive volumes, comparable in size to a human cell, is essential for validating simulations and models currently used to improve treatment efficiency. For more than ten years, CEA-LIST-Diamond Sensors Laboratory (LCD) in France has been performing research on diamond



Ion Beam Induced Charge collection (IBIC) experiments, and the results, performed at the Centre for Medication Radiation Physics (CMRP) and ANSTO.

dosimeters for RT applications.

Currently, two novel scCVD diamond-based radiation detectors have been developed at LCD within the framework of Izabella Zahradnik's PhD project, with the intention of providing lineal energy measurements with high spatial resolution in clinical conditions for hadron therapy. This year the University Paris-Saclay PhD student and CEA-LIST-Diamond Sensors Laboratory (LCD) member was awarded a 2018 Scholarship AINSE ANSTO French Embassy (SAAFE) Research Internship Program.

In August 2018, Izabella travelled to Australia for a six-month research internship at the Centre for Medical Radiation Physics (CMRP) at University of Wollongong and ANSTO. There she was able to work with Dr Anatoly Rosenfeld and his team including Dr Tran and Dr Davis (CMRP) and Dr Prokopovich and Dr Pastuovic (ANSTO); a team with strong experience in experimental and theoretical microdosimetry research and its application in hadron therapy.

Both the theoretical and experimental results of this study will be used to optimize the next generation of diamond-based radiation detectors.

In order to obtain a theoretical understanding of the semiconductor's physics, Izabella was involved in the simulation of diamond microdosimeters using Geant4 Monte Carlo radiation transport code. Using the TCAD semiconductor simulation framework she was then able to simulate the charge transport within the sensitive volumes of diamond microdosimeter, which helped her predict the device's radiation response.

For the experimental component of her internship, Isabella worked in CMRP's and ANSTO's advanced laboratories for radiation detectors studies. Here, the new devices developed in France underwent a complete electrical (current-voltage) characterization as well as a preliminary charge collection characterization using alpha spectroscopy.

...a new class of microdosimeters with applications in particle-based therapies and radioprotection in space.

The responses of the diamond membrane microdosimeters to single projectiles were investigated with the Ion Beam Induced Charge collection (IBIC) technique at ANSTO. The active µSVs of the microdosimeter were irradiated using a raster scanning method and the charge transport properties of the device determined with sub-micron precision by measuring the charge collection efficiency (CCE), radiation hardness, 3D spatial definition, and pulse-height spectra. Both the theoretical and experimental results of this study will be used to optimize the next generation of diamond-based radiation detectors.

The results obtained from Izabella's internship have been partially presented at the IEEE NSS MIC 2018 in Sydney, which is one of the most prestigious scientific and engineering international gathers on radiation detector science and instrumentation and their applications in medicine, space, and other industries.

This research at CEA is well aligned with the research program of CMRP, and brings with it an important synergy in the development of a new class of microdosimeters with applications in particle-based therapies and radioprotection in space. This cutting-edge research has been made possible by strong collaboration with ANSTO. Further exchanges between both institutes are planned in the near future.

North Wollongong Beach, Wollongong, Australia.

Conferences and Workshops

AINSE conferences play a major role in the information exchange process for science and technology, providing forums for robust intellectual debate and opportunities for young researchers to present their work to the established research community.

In 2018, AINSE supported the following conferences and events through the provision of sponsorship funding and travel & accommodation assistance for students to attend AINSE-supported conferences. As part of these sponsorship packages, AINSE representatives attended events in order to network with delegates and promote ongoing AINSE programs.

NAME OF EVENT	TYPE OF EVENT	DATE	VENUE	STUDENTS SUPPORTED	STUDENT UNIVERSITIES / ORGANISATIONS
Universities Australia Higher Education Conference 2018	Conference	28th February –1st March	National Convention Centre, Canberra	-	(Event Sponsorship)
38th Berlin School on Neutron Scattering	School	1st–9th March	Helmholtz -Zentrum Berlin für Materialien und Energie, Germany	2	Curtin University of Technology Monash University
12th Congress of the World Federation of Nuclear Medicine & Biology	Conference	20th–24th April	Melbourne Exhibition Convention Centre	4	The University of Sydney Charles Sturt University The University of Auckland
Nuclear techniques for Cultural Heritage	Conference	12th–15th June	ANSTO-AINSE (Sydney)	9	The University of Melbourne Flinders University The Australian National University The University of New England The University of Queensland
Fostering fusion science and ITER participation in Australia.	Conference	28th June	AINSE	2	Curtin University of Technology The University of Western Australia
Australian Synchrotron New User Symposium for 2018	Symposium	11th July	ANSTO (Melbourne)	9	The University of Sydney University of South Australia The University of Wollongong Curtin University of Technology The University of Auckland The University of Queensland Queensland University of Technology Macquarie University Murdoch University

NAME OF EVENT	TYPE OF EVENT	DATE	VENUE	STUDENTS SUPPORTED	STUDENT UNIVERSITIES / ORGANISATIONS
11th World Conference on Neutron Radiography WCNR-11 and Neutron Radiography School	School	30th–31st August and 2nd–7th September	Sydney	3	The University of Western Australia Monash University The University of Queensland
Powder Diffraction at the Australian Synchrotron and OPAL	Workshop	24th–28th September	Sydney	4	Monash University The University of Queensland Murdoch University James Cook University
Neutrons and Food 5	Conference	16th–19th October	Sydney	1	Massey University
Engineering and Physical Sciences in Medicine Conference 2018	Conference	28th–31st October	Adelaide Convention Centre	5	University of Wollongong RMIT University University of Canterbury
South Pacific Environmental Radioactivity Association (SPERA) Conference	Conference	6th–9th November	University of Western Australia	3	The Australian National University Monash University Massey University
AONSA 2018 Neutron School	School	11th–16th November	ANSTO (Sydney)	5	RMIT University The University of Melbourne Swinburne University of Technology The University of Auckland
AINSE/ANBUG Neutron Scattering Symposium	Symposium	19th–21st November	AINSE	12	Monash University The University of Queensland RMIT University The University of Auckland
Heavy Ion Accelerator Symposium 2018	Symposium	19th–21st November	The Australian National University	2	The Australian National University University of South Australia
Joint meeting of the Asian Biophysics Association & the Australian Society	Conference	2nd–6th December	The University of Melbourne	7	The University of Sydney The University of NSW Curtin University of Technology
26th RACI R&D Topics Conference	Conference	2nd–5th December	Canberra	-	(Event Sponsorship)
2018 Australasian Community for Advanced Organic Semiconductors (AUCAOS) Symposium	Symposium	3rd–5th December	Adelaide Hills Convention Centre	9	The University of Queensland The University of Sydney Macquarie University The University of Melbourne James Cook University University of Otago Victoria University of Wellington

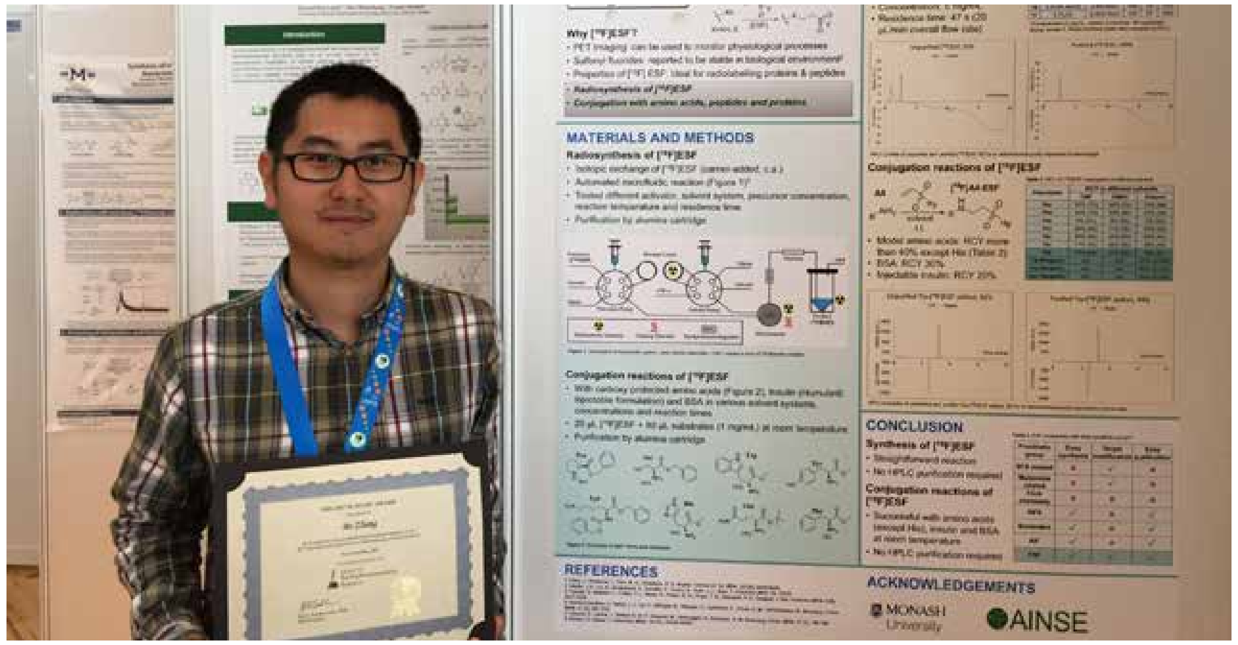
International Travel Scholarships

Throughout the year, students from AINSE-member organisations who are presenting research conducted with an ANSTO collaborator are invited to apply for travel support to attend international conferences. AINSE International Travel Scholarships encourage students to participate in conferences in order to network and exchange ideas with the worldwide nuclear science and engineering community.

AINSE International Travel Scholarships offer up to A$1,000 towards travel expenses. In 2018, AINSE awarded scholarships to twenty-one students to present at numerous high-profile international conferences.

AINSE International Travel Scholarships Awarded in 2018:

STUDENT	MEMBER CODE	CONFERENCE ATTENDED	CONFERENCE LOCATION
Jacob Anderson	OTA	POLAR2018 SCAR Open Science Conference	Davos, Switzerland
Micheline Campbell	UWA	European Geosciences Union General Assembly 2018	Vienna, Austria
Cheng Cao	NSW	SAS 2018 International Small Angle Scattering Conference	Traverse City, USA
Grace Causer	WOL	American Physical Society forum on International Physics March Meeting	Los Angeles, USA
Grace Causer	WOL	Special Award: Travel bursary for Joint European Magnetic Symposia (JEMS)	Mainz, Germany
Gael Cazes	WOL	20th International Rock Art Congress IFRAO 2018	Valcamonica Darfo Boario Terme, Italy
John Demol	MUR	Extraction 2018	Ottawa, Canada
Maja Dunstan	MEL	International Conference on Molecule-based Magnets 2018	Rio de Janeiro, Brazil
Stephanie Florin	QLD	XVIIIth World Congress of the International Union of the Prehistoric and Protohistoric Sciences	Paris, France
Greer Gilmer	OTA	POLAR2018 SCAR Open Science Conference	Davos, Switzerland
Isaac Gresham	NSW	European Colloid and Interface Society Conference 2018	Ljubljana, Slovenia
Hooman Hezaveh Hesar Maskan	ANU	International Congress on Plasma Physics	Vancouver, Canada



AINSE PGRA Scholar Bo Zhang in a poster session at the 22nd International Symposium on Radiopharmaceutical sciences, Dresden, Germany.

STUDENT	MEMBER CODE	CONFERENCE ATTENDED	CONFERENCE LOCATION
Andrew Jones	QLD	American Geophysical Union Fall Meeting 2018	Washington DC, USA
Mitchell Klenner	CUR	22nd International Symposium on Fluorine Chemistry	Oxford, UK
Emma Livingstone	QLD	Protein Society Annual Symposium	Boston, USA
Katrin Mester	DEA	TMS2018 (The Minerals, Metals & Materials Society)	Phoenix, USA
Leonie Peti	AKL	IPA-IAL 2018 Joint Meeting: Unravelling the Past and Future of Lakes	Stockholm, Sweden
Leonie Peti	AKL	INQUA-INTAV International Field Conference and Workshop: Crossing New Frontiers	Brasov, Romania
Mattia Saccò	CUR	24th International Conference on Subterranean Biology	Aveiro, Portugal
Anne Whitworth	MON	2018 Powder Diffraction & Rietveld Refinement School	Durham, UK
Adelle Wright	ANU	19th International Congress on Plasma Physics	Vancouver, Canada
Qingbo Xia	SYD	IUPAC Postgraduate Summer School on Green Chemistry	Venice, Italy
Bo Zhang	MON	22nd International Symposium on Fluorine Chemistry	Oxford, UK

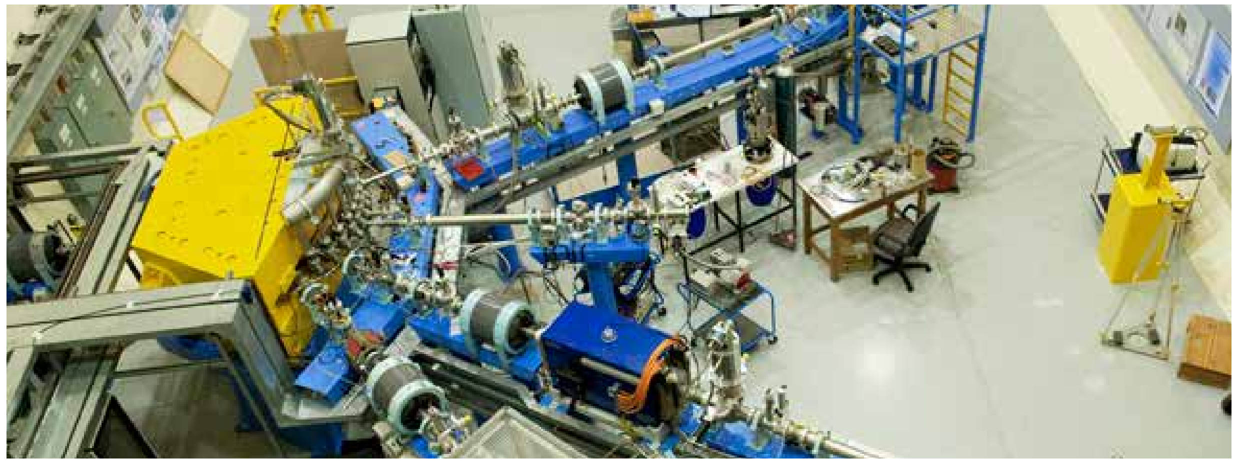
Travel and Accommodation Support

Support for travel and accommodation is provided by ANSTO to AINSE Member Institutions who are awarded access through the ANSTO Research Portal. The following AINSE members received support in 2018.

ANSTO-Funded Travel and Accommodation Support in 2018:

ADE	The University of Adelaide	NCT	The University of Newcastle
AKL	The University of Auckland	NSW	The University of New South Wales
ANU	The Australian National University	QLD	The University of Queensland
CDU	Charles Darwin University	RMI	RMIT University
CSI	CSIRO	SYD	The University of Sydney
CUR	Curtin University of Technology	SWI	Swinburne University of Technology
DEA	Deakin University	TAS	University of Tasmania
FED	Federation University	UNE	The University of New England
FLI	Flinders University	USA	University of South Australia
GRI	Griffith University	USC	University of the Sunshine Coast
LAT	La Trobe University	UWA	The University of Western Australia
MAS	Massey University	VUW	Victoria University of Wellington
MEL	The University of Melbourne	WOL	University of Wollongong
MON	Monash University		

ANSTO's OPAL Multipurpose Reactor at night. Photo credit: ANSTO.



The beamlines of ANSTO's ANTARES accelerator. Photo credit: ANSTO.

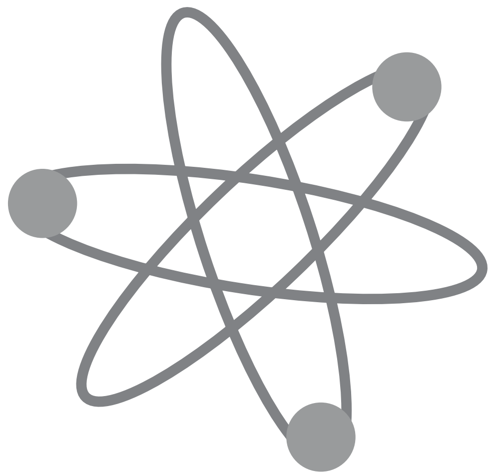
AINSE Supported Facility (ASF) Funding in 2018:

One member organisation was awarded funding in 2018.

INSTITUTION	APPLICANT	PROJECT TITLE	REQUESTED FACILITY	FUNDS AWARDED
The University of Melbourne	Guy Jameson	Reactions of Superoxide with Cysteine Dioxygenase	Linear Accelerator / Pulse Radiolysis Facility, The University of Auckland	$2,475

AINSE Supported Facilities

The Australian Plasma Fusion Research Facility (APFRF)	The Australian National University
Linear Accelerator / Pulse Radiolysis Facility	The University of Auckland
Positron Facilities	The University of Western Australia
Heavy-Ion Accelerator Facility (HAIF)	The Australian National University



Supported Publications

Australian Catholic University

Danielle Hill

Hill, D 2018, 'The effects of temperature and moulting on contaminant regulation in decapod crustaceans', Honours thesis, Australian Catholic University.

The University of Adelaide

Mohammad Alsharifi

Shahrudin, S, Chen, C, David, S C, Singleton, E V, Davies, J, Kirkwood, C D, Hirst, T, R Beard, M & Alsharifi, M 2018, 'Gamma-irradiated rotavirus: A possible whole virus inactivated vaccine', *PLoS One*, vol. 13, no. 6, p.e0198182.
Available from: doi:10.1371/journal.pone.0198182.

Martin Ankor

Ankor, M J 2018, 'Transient groundwater modelling using spreadsheets for education and model prototyping', *Environmental Modelling & Software*, [Online], version 4.
Available from: doi:10.17632/r6hcbkp53n.4.

Georgina Falster

Falster, G, Dlean, S & Tyler, J 2018 'Hydrogen peroxide treatment of natural lake sediment prior to carbon and oxygen stable isotope analysis of calcium carbonate', *Geochemistry, Geophysics, Geosystems,* vol. 19, pp. 3583–3595.
Available from: doi:10.1029/2018GC007575.

Tyler, J, Falster, G, Grant, K, Tibby, J, Turney, C, Löhr, S, Jacobsen, G & Kershaw, P 2018 'Millennial-scale variability in south-east Australian hydroclimate between 30,000 and 10,000 years ago', *Quaternary Science Reviews,* vol. 192, pp.106–122.
Available from: doi:10.1016/j.quascirev.2018.05.031.

Bronwyn Gillanders

Disspain, M C F, Ulm, S, Draper, N, Newchurch, J, Fallon, S & Gillanders, B M 2018 'Long-term archaeological and historical archives for mulloway, Argyrosomus japonicus, populations in eastern South Australia', *Fisheries Research,* vol. 205, pp.1–10.
Available from: doi:10.1016/j.fishres.2018.03.009.

Phillip Pendleton

Madani, H, Arellano, I H, Mata, J P & Pendleton, P 2018 'Particle and cluster analyses of silica powders via small angle neutron scattering', *Powder Technology,* vol. 327, pp.96–108.
Available from: doi:10.1016/j.powtec.2017.12.061.

Julia Short

Short, J 2017, 'Using diatoms as a proxy for measuring the effects of tourism on Fraser Island's unique perched lakes', Honours thesis, The University of Adelaide.

The University of Auckland

Paul Baek

Baek, P 2018, 'Stretchable and self-healing conducting polymers for organic electronics', PhD thesis, The University of Auckland.

Andrew Chan

Naveed Yasin, M, Brooke, R K, Rudd, S, Chan, A, Chen, W-T, Waterhouse, G I N, Evans, D, Rupenthal, I D & Svirskis, D 2018, '3-dimensionally ordered macroporous PEDOT ion-exchange resins prepared by vapor phase polymerization for triggered drug delivery: Fabrication and characterization', *Electrochimica Acta*, vol. 269, pp. 560–570.
Available from: doi:10.1016/j.electacta.2018.02.162.

Michael Hay

Bonnet, M, Hong, C R, Wong, W W, Liew, L P, Shome, A, Wiang, J, Gu, Y, Stevenson, R J, Qi, W, Anderson, R F, Pruijn, F B, Wilson, W R, Jamieson, S M F, Hicks, K O & Hay, M P 2017, 'Next-generation hypoxic cell radiosensitisers: nitroimidazole alkylsulfonamides', *Journal of Medicinal Chemistry*, vol. 61, pp. 1241–1254.
Available from: doi:10.1021/acs.jmedchem.7b01678.

Leonie Peti

Peti, L, Augustinus, P, Gadd, P & Davies, S 2018, 'Fingerprinting rhyolitic tephra layers in New Zealand with µ-XRF core scanning: Towards a faster and non-destructive method for tephrochronology', Oral Presentation presented at the IPA-IAL 2018 Joint Meeting: Unravelling the Past and Future of Lakes, Stockholm, Sweden, June 2018.

Peti, L, Augustinus, P, & Gadd, P 2018, 'Fingerprinting rhyolitic tephra layers in New Zealand with µ-XRF core scanning: Towards a faster and non-destructive method for tephrochronology', Oral Presentation presented at the INQUA-INTAV International Field Conference and Workshop: Crossing New Frontiers, Moieciu de Sus, Romania, June 2018.

Rayomand Shahlori

Shahlori, R, McDougall, D R, Mata, J P & McGillivray, D J 2018, 'Effect of acid molecules on biomimetic mineralisation of calcium phosphate and carbonate within biopolymer films using small angle neutron scattering', *Physica B: Condensed Matter*, vol. 551, pp. 297–304.
Available from: doi:10.1016/j.physb.2018.09.003.

Ravnit Singh

Singh, R 2018, 'Scattering techniques for the measurement of model dispersions — sonicated emulsions, and casein cross-linked by genipin', Honours thesis, The University of Auckland.

The Australian National University

Patrick De Deckker

Perner, K, Moros, M, De Deckker, P, Blanz, T, Wacker, L, Telford, R, Siegel, H, Schneider, R & Jansen, E 2018, 'Heat export from the tropics drives mid to late Holocene palaeoceanographic changes offshore southern Australia', *Quaternary Science Reviews*, vol. 180, pp. 96–110.
Available from: doi:10.1016/j.quascirev.2017.11.033.

Sharon Gray

Gray, S, McPhail, B, Hughes, C, Opdyke, B & Moore, L 2018, 'Interactions between meteoric, surface, and ground water in fractured rock: Upper Murrumbidgee Catchment – preliminary results from meteoric and surface water studies', in *Proceedings from the 22nd Meeting of the International Mineralogical Association, Melbourne*, abstract no. 126, pp. 39–40.
Abstract available from: ima2018.com/ima2018-abstracts/. ISSN: 0729 011X.

Hooman Hezaveh Hesar Maskan

Hezaveh, H, Qu, Z S, Layden, B & Hole, M J 2018, 'Adiabatic frequency chirping of energetic particle driven modes with guiding center orbits', Oral Presentation presented at the International Congress on Plasma Physics, Vancouver, Canada, June 2018.

Michaela Ripper

Ripper, M 2017, 'On the origin of carbon: evaluating the effect of internal pair correlation on the radiative width of the 12C Hoyle state using g-ray angular distribution spectroscopy', Honours thesis, The Australian National University.

Andrew Rowlands

Rowlands, A, Bignell, L & Lane, G 2018, 'Integration of high-speed data acquisition systems for the characterisation of SABRE scintillator', Poster presented at the 8th Conference on Engineering Students Individual Projects (CESIP), Canberra, Australia, May 2018.

Rowlands, A 2018, 'Integration of a high speed digitiser into the data acquisition system for SABRE detector characterisation', Honours thesis, The Australian National University.

Fenja Theden-Ringl

Theden-Ringl, F & Langley, M C 2018, 'At the margins of the high country: a terminal Pleistocene to late Holocene occupation record from Wee Jasper, southeast Australia', *Australian Archaeology*, vol. 84, no. 2, pp. 145–163.
Available from: doi:10.1080/03122417.2018.1510626.

Theden-Ringl, F, Hislop, K, Aplin, K, Grün, R & Schurr, M 2018, 'The chronology and environmental context of a cave deposit and associated faunal assemblage including megafauna teeth near Wee Jasper, Southeast Australia', *The Holocene*, vol. 28, no. 9, pp. 1467–1482.
Available from: doi:10.1177/0959683618777073.

Theden-Ringl, F 2018, 'Common cores in the high country: The archaelology and environmental history of the Namadgi Ranges', PhD thesis, The Australian National University.

Alex Thorman

Thorman, A 2018, 'Polarisation of the Balmer-α emission in crossed electric and magnetic fields', *Journal of Quantitative Spectroscopy and Radiative Transfer*, vol. 207, pp. 8–15.
Available from: doi:10.1016/j.jqsrt.2017.12.015.

Adelle Wright

Wright, A M, Dewar, R L & Hole, M J 2018, 'Application of multi-region relaxed magnetohydrodynamics to resonant magnetic perturbations and internal transport barriers', Oral Presentation presented at the 19th International Congress on Plasma Physics, Vancouver, Canada, June 2018.

University of Canterbury

Yanxiang Meng

Meng, Y 2018, 'Structural and mechanistic characterization of alkylhydroperoxidase D from Streptococcus pneumoniae', Honours thesis, University of Canterbury.

University of Canberra

Corey Goodwin

Goodwin, C, Higgins, D, Tobe, S S, Austin, J, Wotherspoon, A, Gahan, M E & McNevin, D 2018 'Singleplex quantitative real-time PCR for the assessment of human mitochondrial DNA quantity and quality', *Forensic Science, Medicine and Pathology*, vol. 14, no.1, pp. 70–75.
Available from: doi:10.1007/s12024-017-9944-8.

Matthew Jeromson

Jeromson, M R, White, D A, Fink, D, Fujioka, T, Simon, K, Smith, J A, Post, A L & Foster, S 2018, 'What is meteoric-^{10}Be's relationship to Antarctic ice shelves?', Oral Presentation presented at the 26th Annual Royal Australian Chemical Institute Research and Development Topics Conference, Canberra, Australia, December 2018.

White, D A, Fink, D, Post, A L, Simon, K, Galton-Fenzi, B, Foster, S, Fujioka, T, Jeromson, M R, Blaxell, M & Yokoyama, Y 2018 'Beryllium isotope signatures of ice shelves and sub-ice shelf circulation', *Earth and Planetary Science letters*, vol. 505, pp. 86–95.
Available from: doi:10.1016/j.epsl.2018.10.004.

Duanne White

Jeromson, M R, White, D A, Fink, D, Fujioka, T, Simon, K, Smith, J A, Post, A L & Foster, S 2018, 'What is meteoric-^{10}Be's relationship to Antarctic ice shelves?', Oral Presentation presented at the 26th Annual Royal Australian Chemical Institute Research and Development Topics Conference, Canberra, Australia, December 2018.

White, D A, Fink, D, Post, A L, Simon, K, Galton-Fenzi, B, Foster, S, Fujioka, T, Jeromson, M R, Blaxell, M & Yokoyama, Y 2018 'Beryllium isotope signatures of ice shelves and sub-ice shelf circulation', *Earth and Planetary Science letters*, vol. 505, pp. 86–95.
Available from: doi:10.1016/j.epsl.2018.10.004.

Berg, S, White, D A, Bennike, O, Fülöp, R H, Fink, D, Wagner, B & Melles, M 2016 'Unglaciated areas in East Antarctica during the Last Glacial (Marine Isotope Stage 3) – New evidence from Rauer Group', *Earth and Quaternary science reviews*, vol. 153, no.1, pp. 1–10.
Available from: doi:10.1016/j.quascirev.2016.08.021.

Curtin University of Technology

Mitchell Klenner

Klenner, M A, Fraser, B H & Pascali, G 2018 'Re-mediation for radiofluorination of pyridine-based structures', Oral Presentation presented at the 22nd International Symposium on Fluorine Chemistry, Oxford, United Kingdom, July 2018.

Zhang, B, Pascali, G, Wyatt, N, Matesic, L, Klenner, M A, Sia, T R, Guastella, A J, Massi, M, Robinson, A J & Fraser, B H 2018, 'Synthesis, bioconjugation and stability studies of [^{18}F]ethenesulfonyl fluoride', *Journal of Labelled Compounds and Radiopharmaceuticals*, vol. 61, no. 11, pp. 847–856.
Available from: doi:10.1002/jlcr.3667.

Jim Low

Pang, W-K & Low, I M 2018, 'Understanding and improving the thermal stability of layered ternary carbides and nitrides'. In *Advances in Ceramic Matrix Composites (Second Edition)*, pp. 429–460, Woodhead Publishing.
Available from: doi:10.1016/B978-0-08-102166-8.00018-9.

Mattia Sacco

Sacco, M, Blyth, A, Humphreys, W F, Laini, A, Hua, Q & Grice, K 2018 'Elucidating the food web structure of the subterranean invertebrate communities of arid zone Western Australia', Oral Presentation presented at the 24th International Conference on Subterranean Biology, Aveiro, Portugal, August 2018.

Madison Tripp

Tripp, M 2018, 'Exceptionally preserved plant biomolecules in carboniferous Mazon Creek concretions', Honours thesis, Curtin University of Technology.

Deakin University

Francois-Marie Allioux

Allioux, F-M, Kapruwan, P, Milne, N, Kong, L, Fattaccioli, J, Chen, Y & Dumée, L F 2018 'Electro-capture of heavy metal ions with carbon cloth integrated microfluidic devices', *Separation and Purification Technology*, vol. 194, pp. 26–32.
Available from: doi:10.1016/j.seppur.2017.10.064.

Allioux, F-M 2017, 'Hybrid ion-exchange membrane-electrode for advanced catalysis and desalination processes', PhD thesis, Deakin University.

Weiwei Cong

Cong, W, Gao, W, Garvey, C J, Dumée, L F, Zhang, J, Kent, B, Wang, G, She, F & Kong, L 2018 'In situ SAXS measurement and molecular dynamics simulation of magnetic alignment of hexagonal LLC nanostructures', *Membranes (Basel)*, vol. 8, no. 4, p. 123.
Available from: doi:10.3390/membranes8040123.

James Maina

Maina, J W, Schütz, J, Pozo-Gonzalo, C, Kong, L & Dumée, L F 2018, 'Hybrid membrane reactors for converting carbon dioxide to fuel', Poster presented at the 1st International Conference on Energy-efficient Separation (iEESEP2018), Clayton, Australia, January 2018.

Maina, J W, Schütz, J, Grundy, L, des Ligneris, E, Pozo-Gonzalo, C, Kong, L & Dumée, L F 2018, 'Inorganic nanoparticles/carbonized MOF hybrid catalytic reactors for CO_2 conversion', Poster presented at the International Conference on Nanoscience and Nanotechnology (ICONN 2018), Wollongong, Australia, January-February 2018.

Maina, J W, Schütz, J, Grundy, L, Pozo-Gonzalo, C, Kong, L & Dumée, L F 2018, 'Metal organic frameworks (MOFs) derived hybrid carbon photo-electrocatalytic reactors for CO_2 conversion', Poster presented at the 8th Australasian Symposium on Ionic Liquids (ASIL8), Melbourne, Australia, May 2018.

Anne Katrin Mester

Mester, K, Rouxel, B, Langan, T, Lamb, J, Barnett, M, Dorin, T & Wood, K 2018 'Understanding the co-precipitation mechanisms of Al_3(Sc, Zr) with strengthening phases in extruded Al-Cu-Li model alloys', Oral Presentation presented at the Annual Meeting of The Minerals, Metals & Materials Society (TMS2018), Phoenix, United States, March 2018.

Jingshi Wang

Wang, J Chen, X, Reis, R, Chen, Z, Milne, N, Winther-Jensen, B, Kong, L & Dumée, L F 2018 'Plasma modification and synthesis of membrane materials—a mechanistic review', *Membranes*, vol. 8, no.3, p. 56.
Available from: doi:10.3390/membranes8030056.

Federation University

Rachael Martin

Martin, R 2017, 'Historical mine sites as modern-day sources of contamination: Measurement and characterisation of arsenic in historical gold mine wastes to identify the potential for mobility and human exposure', PhD thesis, Federation University.

Adam Trewarn

Trewarn, A, Reeves, J, Panther, B & Reynolds, A 2017 'Analysis of metal concentrations and distributions in surface sediments within Ramsar listed Gippsland Lakes', Oral Presentation presented at the Society of Environmental Toxicology and Chemistry (SETAC) Australasia Conference, Gold Coast, Australia, September 2017.

Flinders University

Jakob Andersson

Andersson, J, Fuller, M A, Wood, K, Holt, S A & Köper, I 2018, 'A tethered bilayer lipid membrane that mimics microbial membranes', *Physical Chemistry Chemical Physics*, vol. 20, no. 18, pp. 12958–12969.
Available from: doi:10.1039/c8cp01346b.

Andersson, J 2018, 'Mimicking microbial membranes', PhD thesis, Flinders University.

Melanie Fuller

Fuller, M & Köper, I 2018, 'Polyelectrolyte-coated gold nanoparticles: The effect of salt and polyelectrolyte concentration on colloidal stability', *Polymers*, vol. 10, no. 12, p. 1336.
Available from: doi:10.3390/polym10121336.

Andersson, J, Fuller, M A, Wood, K, Holt, S A & Köper, I 2018, 'A tethered bilayer lipid membrane that mimics microbial membranes', *Physical Chemistry Chemical Physics*, vol. 20, no. 18, pp. 12958–12969.
Available from: doi:10.1039/c8cp01346b.

Rachael Popelka-Filcoff

Bland, C A, Roberts, A L, Popelka-Filcoff, R S & Santoro, C M 2018, 'Early vitrification stages identified in prehistoric earthenware ceramics from northern Chile via SEM', *Journal of Archaeological Science: Reports*, vol. 16, pp. 309–315.
Available from: doi:10.1016/j.jasrep.2017.09.011.

Stacey Priestley

Priestley, S C, Wohling, D L, Keppel, M N, Post, V E A, Love, A J, Shand, P, Tyroller, L & Kipfer, R 2017, 'Detecting inter-aquifer leakage in areas with limited data using hydraulics and multiple environmental tracers, including ^{4}He, ^{36}Cl/Cl, ^{14}C and ^{87}Sr/^{86}Sr', *Hydrogeology Journal*, vol. 25, no.7, pp. 2031–2047.
Available from: doi:10.1007/s10040-017-1609-x.

Priestley, S C, Kleinig, T, Love, A J, Post, V E A, Shand, P, Stute, M, Wallis, I & Wohling, D L 2017, 'Palaeohydrogeology and transport parameters derived from ^{4}He and Cl profiles in aquitard pore waters in a large multilayer aquifer system, central Australia', *Geofluids*, vol. 2017, article ID 9839861.
Available from: doi:10.1155/2017/9839861.

Priestley, S C, Payne, T E, Harrison, J J, Post, V E A, Shand, P, Love, A J & Wohling, D L 2018, 'Use of U-isotopes in exploring groundwater flow and inter-aquifer leakage in the south-western margin of the Great Artesian Basin and Arckaringa Basin, central Australia', *Applied Geochemistry*, vol. 98, pp. 331–344.
Available from: doi:10.1016/j.apgeochem.2018.10.002.

Priestley, S C 2018, 'Inter-aquifer connectivity: investigating groundwater movement through a regional-scale aquitard using a multi-scale and multi-tracer approach', PhD thesis, Flinders University.

William Tucker

Tucker, W 2018, 'Determining radionuclide concentration ratios for native plant species in arid South Australia', Honours thesis, Flinders University.

Griffith University

Timothy Webb

Webb, T 2017, 'Structure-function relationships in metal hydrides: origin of pressure hysteresis', PhD thesis, Griffith University.

James Cook University

John Dawson

Dawson, J L & Smithers, S G 2014, 'Carbonate sediment production, transport, and supply to a coral cay at Raine Reef, northern Great Barrier Reef, Australia: a facies approach', *Journal of Sedimentary Research*, vol. 84, no. 11, pp. 1120–1138.
Available from: doi:10.2110/jsr.2014.84.

Rosalind Gummow

Gummow, R J & He, Y 2014, 'Mesoporous manganese-deficient lithium manganese silicate cathodes for lithium-ion batteries', *RSC Advances*, vol. 4, no. 23, pp. 11580–11584.
Available from: doi:10.1039/c3ra47730d.

Mohan Jacob

Grant, D S, Siegele, R, Bazaka, K & Jacob, M V 2018, 'Formation of nanocrystalline and amorphous carbon by high fluence swift heavy ion irradiation of a plasma polymerized polyterpenol thin film precursor', *Journal of Applied Polymer Science*, vol. 135, no. 29, p. 46498(1–7).
Available from: doi:10.1002/app.46498.

Grant, D S, Bazaka, K, Davies, J B, Banos, C & Jacob, M V 2018, 'Organic bioelectronic plasma polymerised polyterpenol thin films: preservation of properties relevant to biomedical and organic electronic applications following exposure to sterilising doses of gamma radiation', *Journal of Materials Science: Materials in Electronics*, vol. 29, no. 1, pp. 801–812.
Available from: doi:10.1007/s10854-017-7975-2.

Jacob, M V 2017, 'Investigation into the effects of ionising radiation on plasma polymerised monoterpene alcohols for applications in organic electronics', PhD thesis, James Cook University.

Oluwole Kazum

Kazum, O, Beladi, H & Kannan, M B 2018, 'Hydrogen permeation in twinning-induced plasticity (TWIP) steel', *International Journal of Hydrogen Energy*, vol. 43, no. 50, pp. 22685–22693.
Available from: doi:10.1016/j.ijhydene.2018.10.121.

Theresa Orr

Orr, T 2017, 'Improved pretreatment methods for isolation and decontamination of pyrogenic carbon for radiocarbon dating using hydrogen pyrolysis', Honours thesis, James Cook University.

Emma Ryan

Ryan, E J, Smithers, S G, Lewis, S E, Clark, T R, Zhao, J-X & Hua, Q 2018, 'Fringing reef growth over a shallow last interglacial reef foundation at a mid shelf high island: Holbourne Island, central Great Barrier Reef', *Marine Geology*, vol. 398, pp. 137–150.
Available from: doi:10.1016/j.margeo.2017.12.007.

Sean Ulm

Sloss, C R, Nothdurft, L, Hua, Q, O'Connor, S G, Moss, P T, Rosendahl, D, Petherick, L M, Nanson, R A, Mackenzie, L L, Sternes, A, Jacobsen, G E & Ulm, S 2018, 'Holocene sea-level change and coastal landscape evolution in the southern Gulf of Carpentaria, Australia', *The Holocene*, vol. 28, no. 9, pp. 1411–1430.
Available from: doi:10.1177/0959683618777070.

Rosendahl, D, Ulm, S, Sloss, C, Steinberger, L, Petchey, F, Jacobsen, G, Stock, E & Robins, R 2015, 'Mid-Holocene Aboriginal occupation of offshore islands in northern Australia? A reassessment of Wurdukanhan, Mornington Island, southern Gulf of Carpentaria, Australia', *Quaternary International*, vol. 385, no. 9, pp. 145–153.
Available from: doi:10.1016/j.quaint.2015.02.064.

Rosendahl, D, Ulm, S, Tomkins, H, Wallis, L & Memmott, P 2014, 'Late Holocene changes in shellfishing behaviors from the Gulf of Carpentaria, Northern Australia', *Journal of Island and Coastal Archaeology*, vol. 9, no. 2, pp. 253–267.
Available from: doi:10.1080/15564894.2014.880757.

Christopher Wurster

Wurster, C M, Rifai, H, Haig, J, Titin, J, Jacobsen, G & Bird, M 2017, 'Stable isotope composition of cave guano from eastern Borneo reveals tropical environments over the past 15,000 cal yr BP', *Palaeogeography, Palaeoclimatology, Palaeoecology*, vol. 473, pp. 73–81.
Available from: doi:10.1016/j.palaeo.2017.02.029.

La Trobe University

Henry Kirkwood

Kirkwood, H 2017, 'Energy dispersive methods for polycrystalline materials characterisation', PhD thesis, La Trobe University.

Macquarie University

Sheila Devasahayam

Devasahayam, S 2018, 'Sustainable development of selective iron carbide, silicon carbide and ferrosilicon (low temperature) phases during iron ore reduction using only polymers', *Sustainable Materials and Technologies*, vol. 16, pp. 23–37.
Available from: doi:10.1016/j.susmat.2018.03.001.

Bradley Graves

Graves, B 2017, 'Charcoal preservation and fire history in floodplain wetlands: problems and prospects', Honours thesis, Macquarie University.

Matthew Kosnik

Kowalewski, M, Casebolt, S, Hua, Q, Whitacre, K E, Kaufman, D S & Kosnik, M A 2018, 'One fossil record, multiple time resolutions: Disparate time-averaging of echinoids and mollusks on a Holocene carbonate platform', *Geology*, vol. 46, no. 1, pp. 51–54.
Available from: doi:10.1130/G39789.1.

Peter Nelson

Isley, C F, Nelson, P F, Taylor, M P, Morrison, A, Atanacio, A J, Stelcer, E & Cohen, D D 2018, 'Ambient air quality and indoor exposure: PM2.5 implications for health in Suva, Fiji', *Air quality and climate change*, vol. 52, no. 1, pp. 35–43.

Isley, C F, Nelson, P F, Taylor, M P, Williams, A A & Jacobsen, G E 2018, 'Radiocarbon determination of fossil and modern carbon contribution to aerosol in Suva, Fiji', *Science of The Total Environment*, vol. 643, pp. 183–192.
Available from: doi:10.1016/j.scitotenv.2018.06.182.

Isley, C F, Nelson, P F, Taylor, M P, Stelcer, E, Atanacio, A J, Cohen, D D, Mani, F S & Maata, M 2018, 'Reducing mortality risk by targeting specific air pollution sources: Suva, Fiji', *Science of The Total Environment*, vol. 612, pp. 450–461.
Available from: doi:10.1016/j.scitotenv.2017.08.225.

Neil Saintilan

Kelleway, J J, Mazumder, D, Baldock, J A & Saintilan, N 2018, 'Carbon isotope fractionation in the mangrove Avicennia marina has implications for food web and blue carbon research', *Estuarine, Coastal and Shelf Science*, vol. 205, pp. 68–74.
Available from: doi:10.1016/j.ecss.2018.03.011.

Rory Williams

Williams, R 2018, 'The hydro-geomorphic structure, function and evolution of chains-of-ponds: Implications for recognition of these discontinuous watercourses in river management', PhD thesis, Macquarie University.

The University of Melbourne

Aiden Atkin

Atkin, A 2018, 'Mononuclear lanthanoid complexes as single-molecule magnets', Honours thesis, The University of Melbourne.

Petra Bajo

Bajo, P, Borsato, A, Drysdale, R, Hua, Q, Frisia, S, Zanchetta, G, Hellstrom, J & Woodhead, J 2017, 'Stalagmite carbon isotopes and dead carbon proportion (DCP) in a near-closed-system situation: An interplay between sulphuric and carbonic acid dissolution', *Geochimica et Cosmochimica Acta*, vol. 210, pp. 208–227.
Available from: doi:10.1016/j.gca.2017.04.038.

Kristen Beck

Beck, K K, Fletcher, M-S, Gadd, P S, Heijnis, H, Saunders, K M, Simpson, G L & Zawadzki, A 2018, 'Variance and rate-of-change as early warning signals for a critical transition in an aquatic ecosystem state: A test case from Tasmania, Australia', *Journal of Geophysical Research: Biogeosciences*, vol. 123, no. 2, pp. 495–508.
Available from: doi:10.1002/2017JG004135.

Mariani, M, Beck, K K, Fletcher, M-S, Gell, P, Saunders, K, Gadd, P & Chisari, R 2018, 'Biogeochemical responses to Holocene catchment-lake dynamics in the Tasmanian World Heritage Area, Australia', *Journal of Geophysical Research*, vol. 123, no. 5, pp. 1610–1624.
Available from: doi:10.1029/2017JG004136.

Maja Dunstan

Dunstan, M A, Rousset, E, Boulon, M-E, Piccardo, M, Gable, R W, Sorace, L, Soncini, A, Mole, R A & Boskovic, C 2018, 'Magnetic properties of lanthanoid complexes with redox-active ligands', Poster presented at the 16th International Conference on Molecule-based Magnets (ICMM), Rio de Janeiro, Brazil, September 2018.

Trevor Finlayson

Finlayson, T R, McIntyre, G J & Rule, K C 2018, 'The Martensitic Transformation in indium-thallium alloys', *Proceedings of the International Conference on Martensitic Transformations: Chicago*, pp. 291–297.
Available from: doi:10.1007/978-3-319-76968-4_45.

Michael-Shawn Fletcher

Fletcher, M-S, Bowman, D M J S, Whitlock, C, Mariani, M & Stahle, L 2018, 'The changing role of fire in conifer-dominated temperate rainforest through the last 14,000 years', *Quaternary Science Reviews*, vol. 182, pp. 37–47.
Available from: doi:10.1016/j.quascirev.2017.12.023.

Beck, K K, Fletcher, M-S, Gadd, P S, Heijnis, H, Saunders, K M, Simpson, G L & Zawadzki, A 2018, 'Variance and rate-of-change as early warning signals for a critical transition in an aquatic ecosystem state: A test case from Tasmania, Australia', *Journal of Geophysical Research: Biogeosciences*, vol. 123, no. 2, pp. 495–508.
Available from: doi:10.1002/2017JG004135.

Mariani, M, Beck, K K, Fletcher, M-S, Gell, P, Saunders, K, Gadd, P & Chisari, R 2018, 'Biogeochemical responses to Holocene catchment-lake dynamics in the Tasmanian World Heritage Area, Australia', *Journal of Geophysical Research*, vol. 123, no. 5, pp. 1610–1624.
Available from: doi:10.1029/2017JG004136.

Jay Gordon

Gordon, J 2018, 'Speleothem-based explorations of millennial-scale climate change in southern Australasia', Honours thesis, The University of Melbourne.

Michela Mariani

Mariani, M, Beck, K K, Fletcher, M-S, Gell, P, Saunders, K, Gadd, P & Chisari, R 2018, 'Biogeochemical responses to Holocene catchment-lake dynamics in the Tasmanian World Heritage Area, Australia', *Journal of Geophysical Research*, vol. 123, no. 5, pp. 1610–1624.
Available from: doi:10.1029/2017JG004136.

Fletcher, M-S, Bowman, D M J S, Whitlock, C, Mariani, M & Stahle, L 2018, 'The changing role of fire in conifer-dominated temperate rainforest through the last 14,000 years', *Quaternary Science Reviews*, vol. 182, pp. 37–47.
Available from: doi:10.1016/j.quascirev.2017.12.023.

Mariani, M 2018, 'Palaeofire activity in Western Tasmania: Climate drivers and land-cover changes', PhD thesis, The University of Melbourne.

Monash University

Bruno David

Urwin, C, Skelly, R, Hua, Q & Arifeae, H 2018, 'The chronology of Popo, an ancestral village site in Orokolo Bay, Gulf Province, Papua New Guinea', *Australian Archaeology*, vol. 84, no. 1, pp. 90–97.
Available from: doi:10.1080/03122417.2018.1443900.

Lars Esser

Esser, L, Lengkeek, N, Moffat, B A, Vu, M N, Greguric, I, Quinn, J, Davis, D T & Whittaker, M R 2018, 'A tunable one-pot three-component synthesis of an ^{125}I and Gd-labelled star polymer nanoparticle for hybrid imaging with MRI and nuclear medicine', *Polymer Chemistry*, vol. 9, no. 25, pp. 3528–3535.
Available from: doi:10.1039/C8PY00621K.

Esser, L 2018, 'Designed polymer-based nanoparticles for drug delivery and imaging', PhD thesis, Monash University.

Meiling Han

Han, M 2018, 'Tackling polymyxin resistance in pseudomonas aeruginosa: A multi-disciplinary approach', PhD thesis, Monash University.

Veena Kelleppan

Kelleppan, V T, Moore, J E, McCoy, T M, Sokolova, A V, de Campo, L, Wilkinson, B L & Tabor, R F 2018, 'Self-assembly of long-chain betaine surfactants: Effect of tailgroup structure on wormlike micelle formation', *Langmuir*, vol. 34, no. 3, pp. 970–977.
Available from: doi:10.1021/acs.langmuir.7b02830.

Kelleppan, V 2017, 'The synthesis and analysis of novel betaine surfactants', Honours thesis, Monash University.

Anna Lintern

Lintern, A, Leahy, P, Deletic, A, Heijnis, H, Zawadzki, A, Gadd, P & McCarthy, D 2018, 'Uncertainties in historical pollution data from sedimentary records from an Australian urban floodplain lake', *Journal of Hydrology*, vol. 560, pp. 560–571.
Available from: doi:10.1016/j.jhydrol.2018.03.055.

Thomas McCoy

McCoy, T, de Campo, L, Sokolova, A, Grillo, I, Izgorodina, E & Tabor, R 2018, 'Bulk properties of aqueous graphene oxide and reduced graphene oxide with surfactants and polymers: adsorption and stability', *Physical Chemistry Chemical Physics*, vol. 20, pp. 16801–16816.
Available from: doi:10.1039/C8CP02738B.

McCoy, T, Parks, H & Tabor, R 2018, 'Highly efficient recovery of graphene oxide by froth flotation using a common surfactant', *Carbon*, vol. 135, pp. 164–170.
Available from: doi:10.1016/j.carbon.2018.04.032.

Tabor, R, McCoy, T, Hu, Y & Wilkinson, B 2018, 'Physicochemical and biological characterisation of azobenzene-containing photoswitchable surfactants', *Bulletin of the Chemical Society of Japan*, vol. 91, no. 6, pp. 932–939.
Available from: doi:10.1246/bcsj.20180024.

Kelleppan, V T, Moore, J E, McCoy, T M, Sokolova, A V, de Campo, L, Wilkinson, B L & Tabor, R F 2018, 'Self-assembly of long-chain betaine surfactants: Effect of tailgroup structure on wormlike micelle formation', *Langmuir*, vol. 34, no. 3, pp. 970–977.
Available from: doi:10.1021/acs.langmuir.7b02830.

Marlow, J, Pottage, M J, McCoy, T M, de Campo, L, Sokolova, A, Bell, T D M & Tabor, R 2018, 'Structural and rheological changes of lamellar liquid crystals as a result of compositional changes and added silica nanoparticles', *Physical Chemistry Chemical Physics*, vol. 20, no. 24, pp. 16592–16603.
Available from: doi:10.1039/C8CP02101E.

Moore, J, McCoy, T M, de Campo, L, Sokolova, A V, Garvey, C J, Pearson, G, Wilkinson, B L & Tabor, R F 2018, 'Wormlike micelle formation of novel alkyl-tri(ethylene glycol)-glucoside carbohydrate surfactants: Structure–function relationships and rheology', *Journal of Colloid and Interface Science*, vol. 529, pp. 464–475.
Available from: doi:10.1016/j.jcis.2018.05.060.

McCoy, T 2018, 'Surfactant mediated control of aqueous graphene oxide dispersions', PhD thesis, Monash University.

Bo Zhang

Zhang, B, Robinson, A, Fraser, B H & Pascali, G 2018, '[^{18}F]ethenesulfonyl fluoride: An easy-to-use radiofluoride relay species', Oral Presentation presented at the 22nd International Symposium on Fluorine Chemistry, Oxford, UK, July 2018.

Zhang, B, Pascali, G, Wyatt, N, Matesic, L, Klenner, M A, Sia, T R, Guastella, A J, Massi, M, Robinson, A J & Fraser, B H 2018, 'Synthesis, bioconjugation and stability studies of [^{18}F]ethenesulfonyl fluoride', *Journal of Labelled Compounds and Radiopharmaceuticals*, vol. 61, no. 11, pp. 847–856.
Available from: doi:10.1002/jlcr.3667.

Zhang, B 2018, 'The use of sulfonyl fluorides in PET radiochemistry', PhD thesis, Monash University.

Murdoch University

John Demol

Demol, J, Ho, E & Senanayake, G 2018, 'Sulfuric acid baking and leaching of rare earth elements, thorium and phosphate from a monazite concentrate: Effect of bake temperature from 200 to 800°C', *Hydrometallurgy*, vol. 179, pp. 254–267.
Available from: doi:10.1016/j.hydromet.2018.06.002.

Demol, J, Ho, E & Senanayake, G 2018, 'Sulfuric acid baking and leaching of rare earth elements, thorium and phosphate from a monazite concentrate', Oral Presentation presented at Extraction 2018, Ottawa, Canada, August 2018.

The University of Newcastle

Cherie Colyer-Morris

Colyer-Morris, C 2018, 'An experimental investigation into trophic fractionation and turnover rates by estuarine crabs: stable isotope evidence to support field studies', Honours thesis, The University of Newcastle.

Alexander Gregg

Jidling, C, Hendriks, J N, Wahlstrom, N, Gregg, A W T, Schön, T B, Wensrich, C M & Wills, A 2018, 'Probabilistic modelling and reconstruction of strain', *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*, vol. 436, pp. 141–155.
Available from: doi:10.1016/j.nimb.2018.08.051.

Gregg, A W T, Hendriks, J N, Wensrich, C M, Wills, A, Tremsin, A, Luzin, V, Shinohara, T, Kirstein, O, Meylan, M H & Kisi, E H 2018, 'Tomographic reconstruction of two-dimensional residual strain fields from Bragg-edge neutron imaging', *Physical Review Applied*, vol. 10, p. 64034.
Available from: doi:10.1103/PhysRevApplied.10.064034.

Ben Humphreys

Humphreys, B A, Wanless, E J & Webber, G B 2018, 'Effect of ionic strength and salt identity on poly(N-isopropylacrylamide) brush modified colloidal silica particles', *Journal of Colloid and Interface Science*, vol. 516, pp. 153–161.
Available from: doi:10.1016/j.jcis.2018.01.058.

Humphreys, B A 2018, 'Effect of ionic strength and salt identity on PNIPAM brush modified colloidal silica particles', Oral Presentation presented at the MACRO18 World Polymer Congress, Cairns, Australia, July 2018.

Humphreys, B A, Murdoch, T J, Johnson, E C, Prescott, S W, Nelson, A, Gilbert, E P, Webber, G B & Wanless, E J 2018, 'Brush modified colloidal silica particles and the Hofmeister series', Oral Presentation presented at the 31st Australian Colloid and Surface Science Student Conference, Warrnambool, Australia, January 2018.

Humphreys, B A 2018, 'The internal structure of a brush layer', Oral Presentation presented at the 2018 ANBUG-AINSE Neutron Scattering Symposium, Lucas Heights, Australia, November 2018.

Humphreys, B A 2018, 'Using neutrons to thoroughly interrogate a PNIPAM brush layer', Oral Presentation presented at the Sydney Surfaces And Soft Stuff meeting 2018, Sydney, Australia, June 2018.

Murdoch, T J, Humphreys, B A, Johnson, E C, Webber, G B & Wanless, E J 2018, 'Specific ion effects on thermoresponsive polymer brushes: Comparison to other architectures', *Journal of Colloid and Interface Science*, vol. 526, pp. 429–450.
Available from: doi:10.1016/j.jcis.2018.04.086.

Murdoch, T J, Humphreys, B A, Johnson, E C, Prescott, S W, Nelson, A, Wanless, E J & Webber, G B 2018, 'The role of copolymer composition on the specific ion and thermo-response of ethylene glycol-based brushes', *Polymer*, vol. 138, pp. 229–241.
Available from: doi:10.1016/j.polymer.2018.01.053.

Edwin Johnson

Murdoch, T J, Humphreys, B A, Johnson, E C, Webber, G B & Wanless, E J 2018, 'Specific ion effects on thermoresponsive polymer brushes: Comparison to other architectures', *Journal of Colloid and Interface Science*, vol. 526, pp. 429–450.
Available from: doi:10.1016/j.jcis.2018.04.086.

Murdoch, T J, Humphreys, B A, Johnson, E C, Prescott, S W, Nelson, A, Wanless, E J & Webber, G B 2018, 'The role of copolymer composition on the specific ion and thermo-response of ethylene glycol-based brushes', *Polymer*, vol. 138, pp. 229–241.
Available from: doi:10.1016/j.polymer.2018.01.053.

Johnson, E C, Prescott, S W, Murdoch, T J, Nelson, A & Gresham, I J 2018, 'Mixed salt effects and multi-stimuli responsive polymer brushes: Towards the investigation of complex brush systems', Oral Presentation presented at the 31st Australian Colloid and Surface Science Student Conference, Warrnambool, Australia, January 2018.

Johnson, E C, Prescott, S W, Murdoch, T J, Nelson, A & Gresham, I J 2018, 'Specific ion effects on the thermoresponse of POEGMA polymer brushes in mixed ion environments', Oral Presentation presented at the Sydney Surfaces And Soft Stuff meeting 2018, Sydney, Australia, June 2018.

Timothy Murdoch

Murdoch, T J, Humphreys, B A, Johnson, E C, Webber, G B & Wanless, E J 2018, 'Specific ion effects on thermoresponsive polymer brushes: Comparison to other architectures', *Journal of Colloid and Interface Science*, vol. 526, pp. 429–450.
Available from: doi:10.1016/j.jcis.2018.04.086.

Murdoch, T J, Humphreys, B A, Johnson, E C, Prescott, S W, Nelson, A, Wanless, E J & Webber, G B 2018, 'The role of copolymer composition on the specific ion and thermo-response of ethylene glycol-based brushes', *Polymer*, vol. 138, pp. 229–241. Available from: doi:10.1016/j.polymer.2018.01.053.

Murdoch, T 2018, 'Specific ion effects on stimulus-responsive polymer brushes', PhD thesis, The University of Newcastle.

Alessandra Suzzi

Suzzi, A 2018, 'Tracking the impacts of sewage overflows on ecosystem function using novel techniques', Honours thesis, The University of Newcastle.

Valentina Vanghi

Vanghi, V 2018, 'Advancement in speleothems petrography and microstratigraphy as proxies of climate and environmental changes', PhD thesis, The University of Newcastle.

Erica Wanless

Wanless, E 2018, 'Specific ion effects in polymer brushes', Oral Presentation presented at the 8th International Colloids Conference, Shanghai, China, June 2018.

Grant Webber

Cooper, P K, Li, H, Yepuri, N R, Nelson, A, Webber, G B, Le Brun, A P, Darwish, T A, Warr, G G & Atkin, R 2018, 'Ionic liquid adsorption at the silica−oil interface revealed by neutron reflectometry', *The Journal of Physical Chemistry C*, vol. 122, no. 42, pp. 24077–24084. Available from: doi:10.1021/acs.jpcc.8b05952.

Webber, G 2018, 'Controlling the thermoresponse of ethylene glycol-based brushes, Oral Presentation presented at the MACRO18 World Polymer Congress, Cairns, Australia, July 2018.

The University of New South Wales

Cheng Cao

Cao, C, Zhao, J, Chen, F, Lu, M, Khine, Y Y, Macmillan, A, Garvey, C J & Stenzel, M H 2018, 'Drug-induced morphology transition of self-assembled glycopolymers: Insight into the drug−polymer interaction', Oral Presentation presented at the SAS2018 International Small Angle Scattering Conference, Michigan, USA, October 2018.

James Christian

Christian, J 2018, 'Materials for the next generation of batteries', PhD thesis, The University of New South Wales.

Blake Cochran

Kopecky, C M, Ryder, W J, Szajer, J, Parmar, A, Pandzic, E, Rye, K A & Cochran, B J 2018, 'Translocator protein as novel marker for early atherosclerosis', Poster presented at Vascular Discovery: From Genes to Medicine Scientific Sessions 2018, San Francisco, USA, May 2018.

Isaac Gresham

Gresham, I J, Murdoch, T J, Humphreys, B A, Johnson, E C, Webber, G B. Wanless, E J, Nelson, A & Prescott, S W 2018, 'Structural resolution of responsive polymer brushes with neutron reflectometry: findings, limitations and a model-free Monte Carlo analysis method', Oral Presentation presented at the European Colloid and Interface Society (ECIS) Conference 2018, Ljubljana, Slovenia, September 2018.

Stephen Harris

Harris, S, Liisberg, J, Wolf, B, Xia, L, Yu, L, Wei, J, Kelly, B, Blunier, T & Mohn, J 2018, 'Comparison of N_2O isotope spectrometers for high-precision measurements in ambient air and incubation experiments', Paper presented at the 2018 Annual Meeting of the German Association for Stabile Isotope Research, Munich, Germany, October 2018.

Harris, S J, Cendon, D, Hankin, S & Kelly, B F 2018, 'Occurrence and controls on N_2O accumulation in the lower Namoi alluvial aquifer, Australia', *Geophysical Research Abstracts*, vol. 20, EGU2018-10576.

Lay, A, Harris, S, Graham, I, Colchester, D, Martin, L, Privat, K, Bennett, J, Stopic, A, McGowan, N & Spruzeniece L 2018, 'Mineralogy past, present and future: preparing for the next 100 Years of the Mineralogical Society of America', Oral Presentation presented at the XXII meeting of the International Mineralogical Association, Melbourne, Australia, August 2018.

Harris, S J, Graham, I T, Lay, A & Colchester, D M 2017, 'Complex smoky quartz crystals from the sediment-hosted Manuka Zn–Pb–Ag deposits, Cobar Basin, New South Wales', *Australian Journal of Mineralogy*, vol. 18, pp. 5–21.

Graham, I T, Harris, S J, Lay, A, Colchester, D M, Martin, L, Privat, K, Bennett, J, Stopic, A, McGowan, N & Spruzeniece, L 2017, 'Orogenesis through the looking glass – insights into the evolution of the Manuka MVT deposit through its quartz crystals', Oral Presentation presented at the Geological Society of Australia Specialist Group in Geochemistry, Mineralogy and Petrology (SGGMP) Annual Meeting, Benalla, Australia, September 2017.

Lay, A, Harris, S J, Graham, I T, Lennox, P, Privat, K, Cook, N & George, L 2017, 'Primary silver mineralisation from the Manuka MVT Deposit, Cobar Basin, central New South Wales, Australia', Oral Presentation presented at the Society of Economic Geologists, Beijing, China, September 2017.

Mia Maric

Maric, M 2018, 'Influence of cold-rolling and welding on the molten salt corrosion resistance of 316L stainless steel', Honours thesis, The University of New South Wales.

Lance Maul

Maul, L 2018, 'Impact of new nuclear data on neutronic calculations of the OPAL Reactor using Serpent', *Annals of Nuclear Energy*, vol. 115, pp. 523–533. Available from: doi:10.1016/j.anucene.2018.02.019.

Sumaya Mozumder

Mozumder, S 2017, 'Hyperglycemia and increased β-cell cholesterol are associated with β-cell volume alteration', Honours thesis, The University of New South Wales.

Luke Steller

Stellar, L 2016, 'Origin of boron in hot spring deposits from the 3.48 Ga Dresser Formation, Pilbara Craton: Insights from modern analogues in India and Indonesia', Honours thesis, The University of New South Wales.

Sunny Wang

Wang, S 2017, 'Modification of negative thermal expansion materials via electrochemical insertion', Oral Presentation presented at the Royal Australian Chemical Institution (RACI) Centenary Congress, Melbourne, Australia, July 2017.

Wang, S 2017, 'Modification of negative thermal expansion materials via electrochemical ion insertion', Poster presented at the 2017 ANSTO User Meeting, Melbourne, Australia, November 2017.

Wang, S 2017, 'Modification of negative thermal expansion materials via electrochemical ion insertion', Honours thesis, The University of New South Wales.

University of Otago

Jacob Anderson

Anderson, J, Wilson, G, Fink, D, Jones, R & Fujioka, T 2018, 'Deglacial history of the western Ross Sea since the Last Glacial Maximum', Oral Presentation presented at the POLAR 2018 SCAR/IASC Open Science Conference, Davos, Switzerland, June 2018.

Anderson, J, Wilson, G, Fink, D, Jones, R & Fujioka, T 2018, 'Deglacial history of the western Ross Sea since the Last Glacial Maximum', Poster presented at the POLAR 2018 SCAR/IASC Open Science Conference, Davos, Switzerland, June 2018.

Greer Gilmer

Gilmer, G, Moy, C M, Nichols, J E, Browne, I M, Curtin, L, Vandergoes, M J, Jacobsen, G, Aebig, C H F & Wilson, G S 2018, 'Sediment records of climate variability from the subantarctic Auckland Islands', Oral Presentation presented at the POLAR 2018 SCAR/IASC Open Science Conference, Davos, Switzerland, June 2018.

The University of Queensland

Chris Clarkson

Norman, K, Inglis, J, Clarkson, C, Faith, J T, Shulmeister, J & Harris, D 2018, 'An early colonisation pathway into northwest Australia 70-60,000 years ago', *Quaternary Science Reviews*, vol. 180, pp. 229–239. Available from: doi:10.1016/j.quascirev.2017.11.023.

Emily Field

Field, E, Marx, S, Haig, J, May, J-H, Jacobsen, G, Zawadzki, A, Child, D, Heijnis, H, Hotchkis, M, McGowan, H & Moss, P 2018, 'Untangling geochronological complexity in organic spring deposits using multiple dating methods', *Quaternary Geochronology*, vol. 43, pp. 50–71. Available from: doi:10.1016/j.quageo.2017.10.002.

Stephanie Florin

Florin, S A, Fairbairn, A, Clarkson, C & Barry, L 2018, '65,000 years of human adaptation to broad-scale environmental change in western Arnhem Land, Australia: Preliminary archaeobotanical results from Madjedbebe', Oral Presentation presented at the XVIIIth World Congress of the International Union of the Prehistoric and Protohistoric Sciences, Paris, France, June 2018.

Madison Hoffman

Hoffman, M 2017, 'Assessment of radioactivity form and general sediment activity from the Montebello Islands', Honours thesis, The University of Queensland.

Andrew Jones

Jones, A & Jacobsen, G 2018, 'Investigation of the mechanisms driving ancient soil carbon stability in deep B-horizons of a giant podzol chronosequence (Cooloola)', Oral Presentation presented at the 2018 American Geophysical Union Fall Meeting, Washington D.C., USA, December 2018.

Emma Livingstone

Livingstone, E & Whitten, A 2018, 'Characterisation of protein complexes essential to cellular trafficking', Poster presented at the 32nd Annual Symposium of The Protein Society, Boston, USA, July 2018.

Jake McEwan

Clulow, A J, Nelson, A, Jansen-van Vuuren, E D, Burn, P L & Gentle, I R 2018, 'Morphology of OLED film stacks containing solution-processed phosporent dendrimers', *Applied Materials and Interfaces*, vol. 10, no. 4, pp. 3848–3855. Available from: doi:10.1021/acsami.7b15542.

Liam Neill

Neill, L 2018, 'Understanding 'Diagnostic Impact Fractures': Identifying projectile delivery systems using controlled trials on standardised porcelain armatures', Honours thesis, The University of Queensland.

Kasih Norman

Norman, K 2017, 'Modelling modern human maritime migration pathways from Asia to Pleistocene Sahul', Honours thesis, The University of Queensland.

Grace Scullett-Dean

Scullett-Dean, G 2018, 'Trace element speciation and incorporation in iron oxides within bauxite residues', Honours thesis, The University of Queensland.

Judith Vink

Vink, J 2018, 'Late Glacial to early Holocene environments of Yellow Marsh, Surrey Hills in North West Tasmania', Honours thesis, The University of Queensland.

Queensland University of Technology

Tim Dargaville

Dargaville, T R, Park, J-R & Hoogenboom, R 2018, 'Poly(2-oxazoline) hydrogels: State-of-the-art and emerging applications', *Macromolecular Bioscience*, vol. 18, no. 6, p. 1800070.
Available from: doi:10.1002/mabi.201800070.

Konstantin Momot

Tadimalla, S, Tourell, M C, Knott, R & Momot, K I 2018, 'Assessment of collagen fiber orientation dispersion in articular cartilage by small-angle X-ray scattering and diffusion tensor imaging: Preliminary results', *Magnetic Resonance Imaging*, vol. 48, pp. 115–121.
Available from: doi:10.1016/j.mri.2017.12.032.

Madjid Sarvghad

Sarvghad, M, Steinberg, T A & Will, G 2018, 'Corrosion of stainless steel 316 in eutectic molten salts for thermal energy storage', *Solar Energy*, vol. 172, no. 2, pp. 198–203.
Available from: doi:10.1016/j.solener.2018.03.053.

Sarvghad, M, Will, G & Steinberg, T A 2018, 'Corrosion of steel alloys in molten NaCl + Na_2SO_4 at 700 °C for thermal energy storage', *Solar Energy Materials and Solar Cells*, vol. 179, pp. 207–216.
Available from: doi:10.1016/j.solmat.2017.11.017.

Sarvghad, M 2018, 'Corrosion of structural alloys in molten salts for solar thermal energy storage', PhD thesis, Queensland University of Technology.

Southern Cross University

James Sippo

Sippo, J Z, Lovelock, C E, Santos, I R, Sanders, C J & Maher, D T 2018, 'Mangrove mortality in a changing climate: An overview', *Estuarine, Coastal and Shelf Science*, vol. 215, pp. 241–249.
Available from: doi:10.1016/j.ecss.2018.10.011.

Swinburne University of Technology

Samuel Cheeseman

Cheeseman, S 2018, 'Investigating the interactions between Giant Unilamellar Vesicles (GUVs) and nanostructured surfaces', Honours thesis, Swinburne University of Technology.

Stephanie Owen

Owen, S 2018, 'The effects of bactericidal nanostructured surfaces on the attachment responses and proliferation of candida albicans', Honours thesis, Swinburne University of Technology.

The University of Sydney

Calina Betlazar

Betlazar, C, Harrison Brown, M, Middleton, R, Banati, R & Liu, G-J 2018, 'Cellular sources and regional variations in the expression of the neuroinflammatory marker translocator protein (TSPO) in the normal brain', *International Journal of Molecular Sciences*, vol. 19, no. 9, p. 2707.
Available from: doi:10.3390/ijms19092707.

Betlazar, C, Harrison Brown, M, Middleton, R, Banati, R & Liu, G-J 2018, 'Regional and cellular distribution of the translocator protein 18kDa (TSPO) in the normal brain', Poster presented at ComBio 2018, Sydney, Australia, September 2018.

Manuel Graeber

Banati, R B, Wilcox, P, Xu, R, Yin, G, Si, E, Son, E T, Shimizu, M, Holsinger, R M D, Parmar, A, Zahra, D, Arthur, A, Middleton, R, Liu, G-J, Gregoire, M-C & Graeber, M 2018, 'Microglial responses to syngeneic glioblastoma in a 18-kDa translocator protein (TSPO) knockout', Oral Presentation presented at the Sydney Cancer Conference 2018, Sydney, Australia, October 2018.

Bob Hudson

Hudson, B 2017, 'A thousand years before Bagan: Radiocarbon dates and Myanmar's ancient Pyu cities.' In Yian, G, Miksic, J & Aung-Thwin, M (eds.), *Bagan and the World: Early Myanmar and Its Global Connections*, ISEAS–Yusof Ishak Institute, pp. 88–121.

Anthony Katselas

Katselas, A 2018, 'The halogen bond driven self-assembly of 1-iodoperfluorododecane on graphite', Honours thesis, The University of Sydney.

Shir Ling Lim

Lim, S L 2018, 'Evolution of creep damage in 2.25Cr-1Mo (P22) alloy', Honours thesis, The University of Sydney.

Olivia McRae

McRae, O 2017, 'Block copolymer-directed synthesis of porous metal oxides as electrodes for lithium-ion batteries', Honours thesis, The University of Sydney.

Shurui Miao

Miao, S 2018, 'Amphiphilic nanostructure in biocompatible ionic liquids and their mixtures', Honours thesis, The University of Sydney.

Qingbo Xia

Xia, Q, Ling, C D, Schmid, S & Avdeev, M 2018, 'Metaphosphates as sustainable and environment-friendly electrode materials for sodium-ion batteries', Poster presented at the IUPAC Postgraduate Summer School on Green Chemistry, Venice, Italy, July 2018.

University of Tasmania

David Bowman

Prior, L D, Hua, Q & Bowman, D M J S 2018, 'Demographic vulnerability of an extreme xerophyte in arid Australia', *Australian Journal of Botany*, vol. 66, pp. 26–38.
Available from: doi:10.1071/BT17150.

Fletcher, M-S, Bowman, D M J S, Whitlock, C, Mariani, M & Stahle, L 2018, 'The changing role of fire in conifer-dominated temperate rainforest through the last 14,000 years', *Quaternary Science Reviews*, vol. 182, pp. 37–47.
Available from: doi:10.1016/j.quascirev.2017.12.023.

Zanna Chase

Durand, A, Chase, Z, Noble, T L, Bostock, H, Jaccard, S L, Townsend, A T, Bindoff, N L, Neil, H & Jacobsen, G 2018, 'Reduced oxygenation at intermediate depths of the southwest Pacific during the last glacial maximum', *Earth and Planetary Science Letters*, vol. 491, pp. 48–57.
Available from: doi:10.1016/j.epsl.2018.03.036.

Joanna Ellison

Morrison, B V & Ellison, J C 2017, 'Palaeo-environmental approaches to reconstructing sea level changes in estuaries.' In J Weckström, K, Saunders, K, Gell, P & Skilbeck, C (eds.), *Applications of Paleoenvironmental Techniques in Estuarine Studies. Developments in Paleoenvironmental Research*, vol. 20, Springer, Dordrecht, pp. 471–494.
Available from: doi:10.1007/978-94-024-0990-1_19

Chelsea Long

Long, C 2017, 'Investigating the p[otential for volcanic sulphate aerosols to increase the flux of the cosmogenic radionuclide beryllium-10 to ice cores in Law Dome, East Antarctica', Honours thesis, University of Tasmania.

Osha-Ann Rudduck

Rudduck, O-A, Lavers, J L, Fischer, A M, Stuckenbrock, S, Sharp, P B & Banati, R B 2017, 'Inter-annual variation in the density of anthropogenic debris in the Tasman Sea', *Marine Pollution Bulletin*, vol. 124, no. 1, pp. 51–55.
Available from: doi:10.1016/j.marpolbul.2017.07.010.

University of Technology, Sydney

Paige Bromfield

Bromfield, P 2018, 'Development of new radiolabelled tau inhibitors for early diagnosis of Alzheimer's disease', Honours thesis, University of Technology, Sydney.

The University of Western Australia

Micheline Campbell

Campbell, M, Callow, J, McGowan, H, McGrath, G & Wong, H 2018, 'Climate patterns in south-east Australia: the last interglacial vs the last 2K', Poster presented at the European Geosciences Union (EGU) General Assembly 2018, Vienna, Austria, April 2018.

Alice Dix-Matthews

Dix-Matthews, A 2018, 'Structural insights into the phase separation of heterogeneous nuclear ribonucleoprotein K', Honours thesis, The University of Western Australia.

Western Sydney University

Mohammad Alim

Alim, M 2018, 'TiO_2-based semiconductors for solar energy conversion with a focus on Ta-doped TiO_2', PhD thesis, Western Sydney University.

Alexander Craze

Li, L, Craze, A R, Akiyoshi, R, Tsukiashi, A, Hayami, S, Mustonen, O, Bhadbhade, M M, Bhattacharyya, S, Marjo, C E, Wang, Y, Lindoy, L F, Aldrich-Wright, J R & Li, F 2018, 'Direct monitoring of spin transitions in a dinuclear triple-stranded helicate iron(II) complex through X-ray photoelectron spectroscopy', *Dalton Transactions*, vol. 47, no. 8, pp. 2543–2548.
Available from: doi:10.1039/C7DT04190J.

Craze, A R, Howard-Smith, K J, Bhadbhade, M M, Mustonen, O, Kepert, C J, Marjo, C E & Li, F 2018, 'Investigation of the high-temperature spin-transition of a mononuclear iron(II) complex using X-ray photoelectron spectroscopy', *Inorganic Chemistry*, vol. 57, no. 11, pp. 6503–6510.
Available from: doi:10.1021/acs.inorgchem.8b00576.

Craze, A R, Bhadbhade, M M, Kepert, C J, Lindoy, L F, Marjo, C E & Li, F 2018, 'Solvent effects on the spin-transition in a series of Fe(II) dinuclear triple helicate compounds', *Crystals*, vol. 8, no. 10, p. 376.
Available from: doi:10.3390/cryst8100376.

Craze, A R, Sciortino, N F, Badbhade, M M, Kepert, C J, Marjo, C E & Li, F 2017, 'Investigation of the spin crossover properties of three dinulear Fe(II) triple helicates by variation of the steric nature of the ligand type', *Inorganics*, vol. 5, no. 4, p. 62.
Available from: doi:10.3390/inorganics5040062.

Li, L, Neville, S M, Craze, A R, Clegg, J K, Sciortino, N F, Arachchige, K S A, Mustonen, O, Marjo, C E, McRae, C R, Kepert, C J, Lindoy, L F, Aldrich-Wright, J R & Li, F 2017, 'Spin-state patterning in an iron(II) tripodal spin-crossover complex', *ACS Omega*, vol. 2, no. 7, pp. 3349–3353.
Available from: doi:10.1021/acsomega.7b00630.

Howard-Smith, K J, Craze, A R, Badbhade, M, Marjo, C E, Murphy, T D, Castignolles, P, Wuhrer, R & Li, F 2017, 'Syntheses and structure investigations of 3d transition metal complexes with a flexible N_4O_2-donor hexadentate Schiff-base ligand', *Australian Journal of Chemistry*, vol. 70, no. 5, pp. 581–587.
Available from: doi:10.1071/CH16678.

Craze, A R, Huang, X-D, Etchells, I, Zheng, L-M, Bhadbhade, M M, Marjo, C E, Clegg, J K, Moore, E G, Avdeev, M, Lindoy, L F & Li, F 2017, 'Synthesis and characterisation of new tripodal lanthanide complexes and investigation of their optical and magnetic properties', *Dalton Transactions*, vol. 46, no. 36, pp. 12177–12184.
Available from: doi:10.1039/C7DT02556D.

Fanna, D J, Zhang, Y, Li, L, Karatchevtseva, I, Shepherd, N D, Azim, A, Price, J R, Aldrich-Wright, J, Reynolds, J K & Li, F 2016, '3d transition metal complexes with a julolidine–quinoline based ligand: structures, spectroscopy and optical properties', *Inorganic Chemistry Frontiers*, vol. 3, no. 2, pp. 286–295.
Available from: doi:10.1039/C5QI00200A .

Craze, A 2018, 'Investigation of the structure-function relationships in a range of designed metallosupramolecular systems', Honours thesis, Western Sydney University.

Sara Hortal

Hortal, S, Plett, K L, Plett, J M, Cresswell, T, Johansen, M, Pendall, E & Anderson, I C 2018, 'Fungal competition and partner choice in the ectomycorrhizal symbiosis', Oral Presentation presented at CREAF Talks, Barcelona, Spain, May 2018.
Available from: https://www.youtube.com/watch?v=esHBVqK9i40.

Hortal, S, Plett, K L, Plett, J M, Cresswell, T, Johansen, M, Pendall, E & Anderson, I C 2017, 'Role of plant–fungal nutrient trading and host control in determining the competitive success of ectomycorrhizal fungi', Poster presented at the 9th International Conference on Mycorrhiza (ICOM 9), Prague, Czech Republic, August 2018.

Johansen, M, Cresswell, T, Hortal, S, Plett, J M, Plett, K L & Anderson, I C 2015, 'N and P uptake by plants: Overview of isotope ratio mass spectrometry, radioisotopic and synchrotron methods', Oral Presentation presented at the 13th Australasian Environmental Isotope Conference (AEIC), Sydney, Australia, July 2015.

Nicholas Shepherd

Shepherd, N 2018, 'Preparation and characterization of 3d and 3d/4d coordination cages', Honours thesis, Western Sydney University.

Matthew Van Leeuwen

Van Leeuwen, M, Barbosa, G, Ward, R, Gilbert, E, Mata, J, Castignolles, P & Gaborieau, M 2018, 'Can microstructures and molecular dynamics help predict digestibility of rice?', Poster presented at the Sydney Surfaces And Soft Stuff meeting 2018, Sydney, Australia, June 2018.

Barbosa, G, Van Leeuwen, M, Ward, R, Castignolles, P & Gaborieau, M 2018, 'Characterisation of starch in rice by SEM, NMR and CE', Poster presented at the Field-Flow Fractionation (FFF) of polymers, proteins and nanoparticles workshop, Sydney, Australia, June 2018.

Van Leeuwen, M P, Gilbert, E P, Ward, R, Castignolles, P & Gaborieau, M 2018, 'Relating starch structure in rice to its digestibility', Poster presented at the 2018 Rice Industry Field Day, Yanco, Australia, March 2018.

Gaborieau, M, Dizon, K P, Van Leeuwen, M P, Bhullar, K A S, Castignolles, P, Wuhrer, R, Ward, R, Gidley, M J, Graf, R & Spiess, H W 2018, 'Germany-Australia: a solid (-state) NMR connection', Oral Presentation presented at the MACRO18 World Polymer Congress, Cairns, Australia, July 2018.

Thevarajah, J J, Van Leeuwen, M P, Heuls, M, Rouilly, A, Ward, R, Gilbert, E P, Graf, R, Castignolles, P & Gaborieau, M 2018, 'Insights into the heterogeneity of polysaccharides with solid-state NMR spectroscopy', Oral Presentation presented at the 255th American Chemical Society (ACS) National Meeting, New Orleans, USA, March 2018.

Van Leeuwen, M, Mata, J, Gilbert, E, Wuhrer, R, Ward, R, Castignolles, P & Gaborieau, M 2018, 'Supramolecular characterisation of starch in rice by NMR, SAXS and XRD', Oral Presentation presented at the Neutrons and Food 5 conference, Sydney, Australia, October 2018.

Van Leeuwen, M, Barbosa, G, Ward, R, Wuhrer, R, Gaborieau, M & Castignolles, P 2018, 'Towards predicting starchy food digestibility: characterisation of starch by capillary electrophoresis, NMR spectroscopy and more!', Oral Presentation presented at the 68th Australasian Grain Science Conference in Australia (AGSA 2018), Wagga Wagga, Australia, September 2018.

Van Leeuwen, M, Mata, J, Gilbert, E, Ward, R, Castignolles, P & Gaborieau, M 2017, 'Relating the (supra)molecular structure of starch in rice to its digestibility', Oral Presentation presented at the Australian Rice Quality Symposium, Wagga Wagga, Australia, July 2017.

Van Leeuwen, M, Gilbert, E, Ward, R, Muench, G, Castignolles, P & Gaborieau, M 2017, 'Nanostructural characterisation of starch in rice', Poster presented at the ANSTO Health group meeting, Sydney, Australia, October 2017.

Van Leeuwen, M, Mata, J, Gilbert, E, Ward, R, Castignolles, P & Gaborieau, M 2017, 'Supramolecular characterization of starch in rice by NMR, SAXS and XRD', Poster presented at the Gordon Research Conference on Structure and Dynamics of Materials on Many Length and Time Scales, Hong Kong, China, August 2017.

Van Leeuwen, M, Mata, J, Gilbert, E, Ward, R, Castignolles, P & Gaborieau, M 2017, 'Supramolecular characterization of starch in rice by NMR, SAXS and XRD', Poster presented at the Gordon Research Seminar on Neutron Scattering as a Cutting Edge Probe of Structure and Dynamics of Advanced Materials, Hong Kong, China, August 2017.

Victoria University of Wellington

Ryan Schwamm

Schwamm, R 2018, 'Low oxidation state heavy p-block metal compounds supported by di(amido) chelating ligands', PhD thesis, Victoria University of Wellington.

The University of Waikato

Michael Mucalo

Jaine, J E & Mucalo, M R 2018, 'Rapid determination of rhodium, palladium, and platinum in supported metal catalysts using multivariate analysis of laser induced breakdown spectroscopy data', *Spectrochimica Acta Part B: Atomic Spectroscopy*, vol. 145, pp. 58–63.
Available from: doi:10.1016/j.sab.2018.04.009.

University of Wollongong

Tara Brown

Brown, T, Dillon, C T, Holt, S A, Andrews, P C & Piantavigna, S 2018, 'Bismuth-NSAIDs as colorectal cancer chemopreventives', Oral Presentation presented at the ANBUG-AINSE Neutron Scattering Symposium (AANSS 2018), Lucas Heights, Australia, November 2018.

Grace Causer

Causer, G L, Cortie, D L, Zhu, H, Ionescu, M, Mankey, G J, Wang, X & Klose, F 2018, 'Direct measurement of the intrinsic sharpness of magnetic interfaces formed by chemical disorder using a He^+ beam', *ACS Applied Materials & Interfaces*, vol. 10, no. 18, pp. 16216–16224.
Available from: doi:10.1021/acsami.8b03197.

Paull, O H C, Pan, A V, Causer, G L, Fedoseev, S A, Jones, A, Liu, X, Rosenfeld, A & Klose, F 2018, 'Field dependence of the ferromagnetic/superconducting proximity effect in a YBCO/STO/LCMO multilayer', *Nanoscale*, vol. 10, no. 40, pp. 18995–19003.
Available from: doi:10.1039/C8NR01210E.

Kostylev, M, Causer, G L, Lambert, C H, Schefer, T, Weiss, C, Callori, S J, Salahuddin, S, Wang, X L & Klose, F 2018, 'In situ ferromagnetic resonance capability on a polarised neutron reflectometry beamline', *Journal of Applied Crystallography*, vol. 51, pp. 9–16.
Available from: doi:10.1107/S1600576718000535.

Li, Z, Liu, X, Causer, G L, Lin, K-W, Pong, P, Holt, S A, Klose, F & Li, Y-Y 2018, 'Structural evolution of a Ni/NiO_x based supercapacitor in cyclic charging-discharging: A polarized neutron and X-ray reflectometry study', *Electrochimica Acta*, vol. 290, pp. 118–127.
Available from: doi:10.1016/j.electacta.2018.09.051.

Bergenti, I, Manna, P K, Lin, C-H, Graziosi, P, Liu, X, Causer, G L, Liscio, F, Ruotolo, A, Dediu, V A, van Lierop, J, Klose, F & Lin, K-W 2018, 'Surface engineering with Ar^+/O_2^+ ion beam bombardment: Tuning the electronic and magnetic bahaviour of $Ni_{80}Fe_{20}/La_{0.7}Sr_{0.3}MnO_3/SrTiO_3(001)$ junctions', *Journal of Applied Physics*, vol. 124, no. 18, p. 183903.
Available from: doi:10.1063/1.5049235.

Causer, G L, Zhu, H, Shi, D, Ionescu, M, Mankey, G J, Wang, X & Klose, F 2018, 'Tailoring exchange bias properties of ferro/antiferromagnetic $FePt_3$ bilayers created by He^+ beams', *Journal of Physics: Condensed Matter*, vol. 30, no. 31, p. 315804.
Available from: doi:10.1088/1361-648X/aad075.

Causer, G L, Zhu, H, Davis, J, Ionescu, M, Mankey, G J, Wang, X & Klose, F 2018, 'The microstructural evolution of chemical disorder and ferromagnetism in He^+ irradiated $FePt_3$ films', *Applied Surface Science*, vol. 459, pp. 672–677.
Available from: doi:10.1016/j.apsusc.2018.08.028.

Causer, G L, Cortie, D L, Zhu, H, Ionescu, M, Mankey, G J, Wang, X L & Klose, F 2018, 'Depth control of ferromagnetism in thin films by ion irradiation', Oral Presentation presented at the International Conference on Nanoscience and Nanotechnology (ICONN 2018), Wollongong, Australia, February 2018.

Causer, G L, Cortie, D L, Zhu, H, Ionescu, M, Mankey, G J, Wang, X L & Klose, F 2018, 'Depth profiling magnetic interfaces formed intrinsically in $FePt_3$ by ion beams', Oral Presentation presented at the American Physical Society (APS) March Meeting 2018, Los Angeles, USA, March 2018.

Causer, G L, Cortie, D L, Zhu, H, Ionescu, M, Mankey, G J, Wang, X L & Klose, F 2018, 'Direct measurement of the intrinsic sharpness of magnetic interfaces formed by ion beams', Oral Presentation presented at the Joint European Magnetic Symposia (JEMS) 2018, Mainz, Germany, September 2018.

Causer, G L 2018, 'Magnetic interface phenomena in nano-architectures and their applications', Oral Presentation presented at the ANBUG-AINSE Neutron Scattering Symposium (AANSS 2018), Lucas Heights, Australia, November 2018.

Causer, G L, Cortie, D L, Zhu, H, Ionescu, M, Mankey, G J, Wang, X L & Klose, F 2018, 'One PLATYPUS plus some ion beams equals SIRIUS disorder', Oral Presentation presented at the ANSTO Young Researcher Mini-Conference, Lucas Heights, Australia, August 2018.

Causer, G L 2018, 'Physics at the nanoscale: How atoms behaving badly is good news for us', Oral Presentation presented at the Australian Institute of Physics Annual Postgraduate Awards Day, Sydney, Australia, November 2018.

Causer, G L, Cortie, D L, Zhu, H, Ionescu, M, Mankey, G J, Wang, X L & Klose, F 2018, 'The fundamental sharpness of magnetic interfaces formed by chemical disorder using a He^+ beam', Oral Presentation presented at the 23rd Australian Institute of Physics (AIP) Congress, Perth, Australia, December 2018.

Causer, G L 2018, 'Uncovering hidden nanoscale worlds with neutrons', Oral Presentation presented at the Royal Society of New South Wales Scholars Open Lecture, Sydney, Australia, February 2018.

Gael Cazes

Cazes, G, Fink, D, Fülöp, R-H, Codilean, A T & Wilcken, K 2018, 'Title of Article', Oral Presentation presented at the 20th International Rock Art Congress IFRAO 2018, Valcamonica Darfo Boario Terme, Italy, September 2018.

Gemeng Liang

Liang, G, Pillai, A S, Peterson, V K, Ko, K-Y, Chang, C-M, Lu, C-Z, Liu, C-E, Liao, S-C, Chen, J-M, Guo, Z & Pang, W K 2018, 'Effect of AlF_3-coated $Li_4Ti_5O_{12}$ on the performance and function of the $LiNi_{0.5}Mn_{1.5}O_4||Li_4Ti_5O_{12}$ full battery—An *in-operando* neutron powder diffraction study', *Frontiers in Energy Research*, vol. 6, pp. 89–101.
Available from: doi:10.3389/fenrg.2018.00089.

Oliver Paull

Paull, O 2016, 'Magnetic proximity effect in superconductor/insulator/ferromagnet heterostructures', Honours thesis, University of Wollongong.

Melinda Waterman

Robinson, S A, King, D H, Bramley-Alves, J, Waterman, M J, Ashcroft, M B, Wasley, J, Turnbull, J D, Miller, R E, Ryan-Colton, E, Benny, T, Mullany, K, Clarke, L J, Barry, L A & Hua, Q 2018, 'Rapid change in East Antarctic terrestrial vegetation in response to regional drying', *Nature Climate Change*, vol. 8, pp. 879–884.
Available from: doi:10.1038/s41558-018-0280-0.

Long Zhang

Zhang, L, Laborda, E, Darwish, N, Noble, B B, Tyrell, J H, Pluczyk, S, Le Brun, A P, Wallace, G G, Gonzalez, J, Coote, M L & Ciampi, S 2018, 'Electrochemical and electrostatic cleavage of alkoxyamines', *Journal of the American Chemical Society*, vol. 140, no. 2, pp. 766–774.
Available from: doi:10.1021/jacs.7b11628.

Member Codes

ACU	Australian Catholic University
ADE	The University of Adelaide
AKL	The University of Auckland
ANS	ANSTO
ANU	The Australian National University
CAN	University of Canterbury
CBR	University of Canberra
CDU	Charles Darwin University
CQU	CQUniversity
CSU	Charles Sturt University
CSI	CSIRO
CUR	Curtin University of Technology
DEA	Deakin University
DST	Defence Science & Technology Group
ECU	Edith Cowan University
FED	Federation University
FLI	Flinders University
GRI	Griffith University
JAM	James Cook University
LAT	La Trobe University
MAC	Macquarie University
MAS	Massey University
MEL	The University of Melbourne
MON	Monash University
MUR	Murdoch University
NCT	The University of Newcastle
NSW	The University of New South Wales
OTA	University of Otago
QLD	The University of Queensland
QUT	Queensland University of Technology
RMI	RMIT University
SCU	Southern Cross University
SWI	Swinburne University of Technology
SYD	The University of Sydney
TAS	University of Tasmania
UNE	The University of New England
USA	University of South Australia
USC	University of the Sunshine Coast
UTS	University of Technology, Sydney
UWA	The University of Western Australia
UWS	Western Sydney University
VUW	Victoria University of Wellington
WAI	The University of Waikato
WOL	University of Wollongong

Industry Members

THE	Theranostics Australia
VAC	Vacuum Society of Australia

Specialist Areas

AGES	Archaeology, Geosciences and Environmental Sciences
BBS	Biomedical Science and Biotechnology
MSE	Materials Science and Engineering

The Australian Institute of Nuclear Science and Engineering, AINSE Ltd.

EMAIL
ainse@ainse.edu.au

PHONE
+61 2 9717 3376

WEBSITE
www.ainse.edu.au

AINSE Ltd. ABN:
18 133 225 331

MAIL
Locked Bag 2001
Kirrawee DC NSW 2232
Australia

ADDRESS
New Illawarra Road
Lucas Heights NSW 2234
Australia

AINSE Ltd.

Cover Image: A partial view of the AINSE Library collection, housing hundreds of research higher degree theses supported by AINSE over the past 60 years. Image credit: AINSE Ltd.