

A photograph of two female scientists in a laboratory. The scientist in the foreground is wearing safety glasses and a white lab coat, looking off to the side. The scientist in the background is also wearing safety glasses and a white lab coat, looking towards the camera. The background shows laboratory equipment, including a computer monitor and a fume hood.

**ARC Centre of Excellence
for Electromaterials Science**

ANNUAL REPORT 2017

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Welcome

Our Vision is to be the pre-eminent world centre for research in the field of electromaterials science and integrated device assembly.

To achieve this we strive:

- To use our research into advanced materials to deliver innovative device solutions for clean energy and medical bionics.
- To deliver research programs that produce world-class graduates with not only exceptional technical skills, but skills in science communication, research management, commercialisation, and an awareness of the ethical, social and environmental impact of their research.
- To realise commercial opportunities for our research through delivery of step-change technologies that positively impact on quality-of-life issues for the global community.
- To educate, inspire and engage stakeholders and the broader community, by effectively communicating our research messages.

THE ACES PARTNERS

We have established a global network of partners integral to our success in research, training, commercialisation and engagement. ACES welcomed a new Australian node in 2017 – University of NSW. Hence now ACES, led by the University of Wollongong, incorporates eight Australian collaborating organisations and five international partner institutions known for their expertise in materials

and device fabrication.

The collaborating organisations are Deakin University, Monash University, University of Tasmania, The Australian National University, The University of Melbourne, Swinburne University of Technology and the University of New South Wales.

The international partner institutions are Dublin City University, Ireland; University of Warwick, UK; Friedrich Alexander University of Erlangen, Germany; Hanyang University, Korea and Yokohama National University, Japan.

Each node possesses key research strengths that when combined, place ACES in a powerful position to design, discover and develop new electromaterials.

OUR FUNDING

The Australian Research Council invested \$25 million in ACES over 2014-2020 to translate our materials science knowledge into practical, game-changing devices that will have a significant impact in the areas of diagnostics, energy, health and soft robotics.

The NSW Government also invested \$500,000 through its Research Attraction and Acceleration Program (RAAP) to help us facilitate the commercialisation of our research. This is to assist in developing innovative approaches that encourage entrepreneurship and commercialisation.

Our core funded activities provides a fundamental research program, facilities and expenditure that



has enabled us to pursue new opportunities through MedTech and Pharma Growth Centre (MTPConnect) connect funded projects, CRC funded projects, ARC linkage (project and training hubs), NHMRC and ARC discovery projects.



As we work towards our goals, we embrace the challenge of training the next generation of multidisciplinary research leaders, and providing new manufacturing and industrial opportunities for Australia.

The challenges are numerous, but the

opportunities are even greater. The ACES team is committed to building a knowledge base in an environment that ensures effective training that will be used to deliver economic returns for Australia.

The discovery and development of the most advanced materials that transport and transfer charge remains at the core of the ACES research programs.

Director's Report

In this, our year of review by our funding body, the Australian Research Council, we have had the opportunity to reflect, to regroup and to refine our plans going forward.

ACES has reflected on the achievements to date in the areas of electromaterials discovery, processing and fabrication with an ever increasing input from our modelling program. We have confronted the challenges of in-line characterisation, so critical to experimental success involving the fabrication of 3D structures. We have established a platform for rapid advances in electrofluidics and diagnostics, soft robotics, synthetic energy systems and synthetic biosystems.

Building on shorter term focused applications in each of these areas we have identified three grand challenges:

- systems for chemical fuel generation - produced from carbon dioxide or nitrogen
- the soft prosthetic hand - driven by wearable and then implantable electrodes
- the brain on the bench - printed 3D neuronal structures to provide insights into disease development and a test bed to investigate novel interventions

Each of these applications will draw

on a vast array of interdisciplinary skills, including non-technical skills in ethics, policy and public engagement to ensure success.

Our training environment provides a unique opportunity for career development. The acquisition of high level technical skills coupled with interdisciplinary communication skills enables more effective high impact contributions to be realised. Integration into the ACES research and translation networks ensures that career development opportunities are realised.

Over the past three years we have established an integrated and effective end-user network particularly in the areas of health and energy. This end-user network is of great interest to our commercial partners, bringing them closer to their future customer base. Our commercial partners comprise established, emerging, reconfiguring and new industries.

ACES is working to inform regulatory bodies and policy makers on the issues that need to be addressed, as well as with the public to address ethical concerns, and to ensure we bring them along on this exciting journey.

I hope you enjoy reading of our achievements during 2017. Going forward we are determined to use

the fundamental knowledge accrued since the Centre began, in mid 2014, in strategic areas of application to ensure maximum impact.

A huge thanks to all of our collaborators and advisors and a special thank you to the many who have assisted in our preparation for and participation in the ARC review process. The invaluable input of a number of individuals from the research offices at Wollongong and partner institutions is greatly appreciated.

As researchers, we are very conscious of the special opportunities afforded to us by being part of an ARC Centre of Excellence. We are also aware of the responsibility to deliver real impact to the communities we work for.

Best Wishes



Prof Gordon Wallace

Executive Director of ACES

“

We are very conscious of the special opportunities afforded to us by being part of an ARC Centre of Excellence.

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International Advisory Committee Report

ACES personnel continue to progress their vision towards becoming the pre-eminent world centre for research in the field of electromaterials science and integrated device assembly. All ACES key performance indicators are met and often exceeded.

RESEARCH REPUTATION

The discovery and development of the most advanced materials that transport and transfer charge remains at the core of the ACES research programs. ACES use the composition of such materials to drive specific chemical or biological processes as these charge transfer events occur.

Over the first three years of the Centre the challenge at ACES was to develop clever chemistries and fabrication approaches that allowed them to extricate the amazing properties they discovered in the nanodomain and instill them in microstructures and macroscopic devices.

ACES have clear direction on how to tackle the challenge to ensure these exciting properties are utilised in practical applications to deliver innovative device solutions for clean energy and medical bionics.

ACES have shown the various research themes are well integrated and how the impacts from the chemistries and fabrication approaches are impacting on the chosen application areas.

For example, in Soft Robotics the ability to distribute mechanical properties in three dimensions has helped ACES realise the soft prosthetic hand. Recently ACES demonstrated wireless control of the soft prosthetic hand.

In the Synthetic Energy Systems

program the ability to distribute catalytic reactive centres throughout 3D electrodes is helping ACES build systems that can be used to convert carbon dioxide into useful fuels. There has been interest from commercial entities for both carbon dioxide reduction to produce fuels and nitrogen reduction for ammonia production.

The ability to create 3D structures using the advanced electromaterials with distributed active centres has also enabled ACES to deliver better energy storage devices and thermal energy conversion devices.

In the Synthetic Biosystems program the ability to distribute other active centres – living cells – throughout appropriate softer structural materials has been brought closer into being used in current clinical applications as well as enabling ACES to engage in unprecedented fundamental studies. The ability to position stem cells throughout a 3D structure and to study the effect on the environment created for stem cell development is providing extraordinary fundamental insights.

In the Electrofluidics program the ability to create 3D structures means that ACES can build systems wherein they have control over fluid movement as well as the movement of specific molecules contained in the fluids. Such control is enabling advances in new flow battery technology.

Through the remaining years of the grant ACES aim to develop diagnostic systems to interrogate the three dimensional structures containing living cells. This is an important aspect in the ACES brain on the bench project; established to obtain insights into the development of diseases such as epilepsy and schizophrenia.

ACES has developed 3D electrode

structures and subsequent electrophysiology experiments have shown ACES has functional neural networks, which will provide input into neurally driven prosthetic devices.

Being at the forefront of these research areas nationally and internationally ACES are conscious of the need to engage as a research community in areas such as ethics, policy and public engagement and do so. During 2017 ACES has been asked onto numerous discussion panels and invited to give keynote or plenary lectures at international symposiums to discuss the new technologies on the horizon and how they may impact future directions. All the projects described above have involved input from the ACES ethics, public engagement and policy theme.

CI Susan Dodds is recognised internationally for her contributions to government and health service understanding of the ethical impact of emerging technologies; invited in 2017 by the World Health Organisation to present on the ethical challenges for national research ethics bodies arising from 3D bioprinting and neural implants.

ACES EPPE members were drivers in co-ordinating a meeting, held in India in 2017, that looked at how to join good science with good governance of materials sourcing, respect for land-holders rights and ethical supply chains. CI Hancock gave a special address in the inaugural plenary session discussing implications for sustainable development initiatives in supporting business and policy contributions towards positive social, economic and environmental impacts.

Facilities are being improved at all ACES nodes and there has been an

increase in the number of new facilities accessible to ACES members.

The vast body of fundamental knowledge ACES and their collaborators generate is shared with the scientific community. Members have published nearly 750 journal publications that have received 7,345 citations from 90 countries since 2014.

Substantial time and resources are required to invest in identifying and building collaborations so they are strong and productive - ACES members should be commended. In 2017 ACES published 103 publications with international co-authors, from 30 countries and 157 institutions.

SCIENTIFIC AWARDS

ACES members were again recipients of a number of prestigious honours in 2017.

- Australian Laureate Fellow, UOW Distinguished Professor Gordon Wallace, appointed an Officer in the General Division of the Order of Australia (AO) for his commitment to research collaboration and innovation.
- The ACES Director Gordon Wallace named 2017's NSW Scientist of the Year.
- ACES Associate Director Maria Forsyth received the Victoria Prize for Science and Innovation in Physical Sciences.
- ACES Synthetic Energy Systems Theme leader and Communications Director, CI Doug MacFarlane was awarded the Australian Academy of Science 2018 David Craig Medal.
- CI Michelle Coote was awarded the ARC Georgina Sweet Australian Laureate Fellowship.
- ACES Synthetic Bioystems Theme leader, CI Mark Cook, was elected Fellow of the Australian Academy of Health and Medical Sciences.
- The team behind the Biopen were finalists in Australian Museum Eureka Prizes.

Such awards are testimony to the ability of ACES to undertake highly innovative

and potentially transformational research leading to a significant increase in capabilities and knowledge.

RESEARCH TRAINING

ACES continues to commit to being at the forefront of research training initiatives. The technical training is at the core of what ACES do, but today's researcher needs more than just technical training.

ACES provide their graduates with skills in communication on how to engage across disciplines and at many levels to both scientific and public communities. ACES provide an awareness of the ethical and policy issues that will arise from their research. By developing the Certificate in Entrepreneurship and Innovation young ACES researchers are encouraged to maximise end-user engagement and consider commercial opportunities. The ACES graduates are poised to achieve much in their future careers.

The formal qualification courses of the Masters in Philosophy (Biofabrication) and Masters in Philosophy (Electromaterials) have been designed to ensure that the students gain maximum benefit from the unique multidisciplinary expertise in ACES in a bid to prepare skilled people who can progress the technology.

The 3D bioprinting MOOC continues to provide an effective and efficient conduit for the introduction of the rapidly emerging topic of 3D printing. Aimed at a community level of understanding, more than 25,000 people have engaged to date.

TRANSLATION

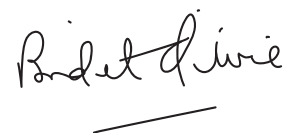
Moving into the second half of their funding cycle ACES is very well placed to advance applications in the energy and health arenas - the underlying knowledge and available fabrication, prototyping and characterisation tools

have all been developed. ACES, in partnership with ANFF, provide state-of-the-art facilities and highly skilled personnel in materials research.

The ACES end-user network continues to grow. Events including clinicians, industry and government entities have been used to facilitate expansion.

ACES constantly works to leverage off Centre activities and expertise to attract funding for translational aspects of their research. ACES taps into existing schemes, such as CRCs, ARC linkage hubs, ARC linkage projects and NHMRCs. They engage with industry – established and emerging. They look for new opportunities to progress developments.

"In its previous reports the IAC has been impressed at the progress ACES has made in all its activities. The review by the ARC in 2017 has confirmed this view. The IAC looks forward with confidence to the continual success of this excellent nationally and internationally successful group in the coming years"



Dr (Dame) Bridget Ogilvie (AC, DBE, FAA, FRS, FMedSci), chair of the ACES International Advisory Board.



ACES Research

The fourth year of ACES research, 2017, has, as planned, been a year of transition. We have built a fundamental knowledge base in electromaterials and reactive systems that can be distributed throughout appropriate structure materials. We have also established materials processing and fabrication approaches that enable the assembly of 3D structures based on these.

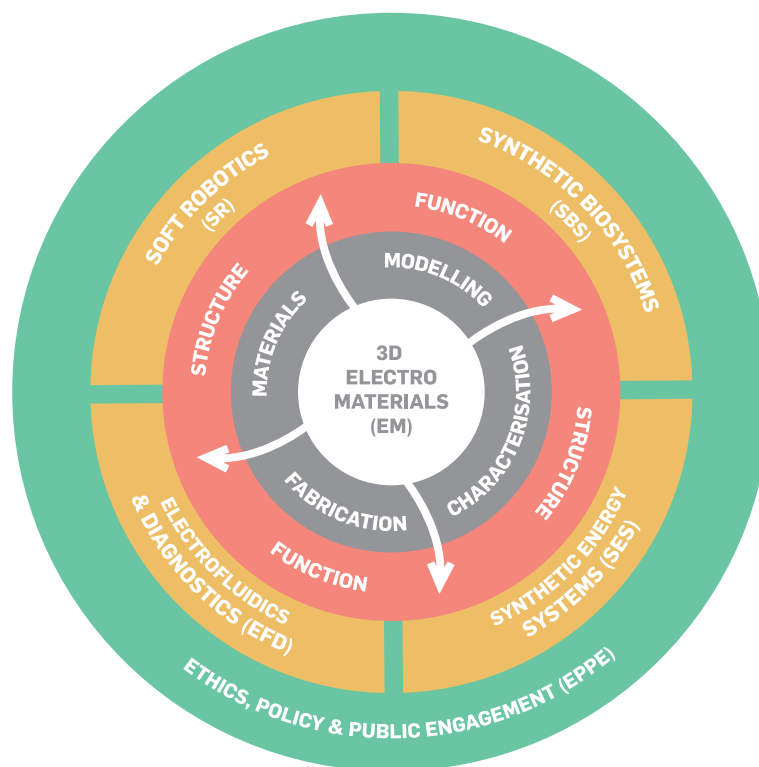
For the next three years our attention will turn towards the use of this knowledge to create high impact outcomes in electrofluidics and diagnostics, soft robotics, synthetic energy systems and synthetic biosystems.

ACES STRATEGIC PLAN GOAL 1: RESEARCH

Our goal is to deliver integrated nano-assembly and fabrication technologies with the capacity to build truly biomimetic electrochemical systems by drawing on advances in materials, 3D printing and fibre spinning, characterisation and modelling.

ADVANCING OUR GOAL

In the ACES research program, we are committed to undertaking world class research to produce high impact knowledge, which in turn contributes to National Research Priorities through the creation or transformation of industries. ACES is achieving this through fundamental and applied research in 3D electromaterials systems and the application of these in soft robotics, electrofluidics and diagnostics, synthetic energy systems and synthetic



Schematic 1: ACES core 3D electromaterials research theme and associated application themes

biosystems.

This has been a year in transition between the primary centre focus on electromaterial fundamental and 3D structure / function studies and the development of systems and devices. Fundamental studies have enabled the development of both Generation 1 materials (Table 1) and Generation 2 materials (Table 2). Using innovative assembly and fabrication approaches novel 3D structures containing these materials have been created.

The common requirement across all ACES activities is the realisation of 3D structures in which the spatial distribution of the required functional elements can be controlled. The

effect of 3D structure on the common functions of charge transfer, reaction centre reactivity and structural support has been a primary focus through structure-function studies. These have been undertaken within each of the technical theme areas, leading in some cases to the development of devices, some of which are included in the 'Research in Action case studies'.

3D ELECTROMATERIALS

In order to achieve the ACES aim of creating the next generation of electrochemical devices, it continues to be necessary to create complex 3D electromaterial structures

Table 1: Generation 1 Materials

Composition	Structural	Electromaterial	Reaction Centre	Fabrication
Titanium	✓	✓	✓ (Photo catalyst)	3D metal printing
Nickel	✓	✓	✓ (Electro catalyst)	3D metal printing
Stainless steel	✓	✓	x	3D metal printing
CMC-silver	✓	x	x	3D printable
Liquid crystalline graphene oxide	✓	✓ (After reduction)	x	3D printable
Graphene	✓	✓	x	Film formation
Nanodiamond	✓	x	x	Film formation
Ulvans	✓	x	✓ (Heparin-like)	To be investigated
Methacrylated gelatin (GelMA)	✓	x	x	Printable ink
Alginate	✓	x	x	3D printable
Conducting polymers	x	✓ (Cell growth)	x	Films and fibres
Ionic liquids	x	✓	x	As part of electrolytes
Metalloporphyrins	x	x	✓ (Electrocatalysts, light harvesters)	Print with other structural material or electromaterial
Metal oxides	x	x	✓ (Charge storage, water oxidation)	Fabricate with other structural material or electromaterial
Redox couples	x	x	✓ (Thermocells)	As part of electrolytes
IPS cells	x	x	✓	Printable with CMC-silver
Adipose stem cells	x	x	✓	Printable with alginate

typically using the ACES Generation 1 and 2 structural, electroactive or reaction centre materials (Tables 1 and 2) that have been developed through appropriate modelling and characterisation.

The challenge in the development of complex 3D electromaterial structures is ensuring that they not only have the required properties for the intended application but also are amenable to

fabrication. The extensive materials catalogue built up over the last three years in ACES comprises light harvesting materials, conducting polymers, metals and metal salts, 2D materials, redox mediators, ionic liquids and biomaterials. This provides ACES with an extraordinarily rich material source from which to fabricate a diverse range of 3D structures as evidenced below.

ASSEMBLY AND FABRICATION

The development of water soluble metalloporphyrins highlights the ACES approach in developing catalytic materials that can then be modified for material fabrication. Having demonstrated the efficacy of an iron porphyrin for the electrocatalytic homogeneous reduction of carbon dioxide (CO₂) in an organic solvent

Table 2: Generation 2 Materials

Composition	Structural	Electromaterial	Reaction Centre	Fabrication
Layered transition metal dichalcogenides including MoS ₂	✓	✓	✓	Film formation or 3D printable
2D nanocarbon such as carbon nanodots	✓	✓	✓ (After functionalisation)	Film formation
Graphene composites	✓	✓	✓	Film formation or 3D printable
Metal-graphenic composites	✓	✓	✓ (After functionalisation)	3D metal printing
New metal powders such as Cu/Ni	✓	✓	x	3D metal printing
Metal organic frameworks (MOFs)	✓	✓	✓	Self assembled films or printed
Gallium alloys	x	✓	x	3D printable
Co/Ni/Fe complex redox mediators	x	✓	x	Printable as liquids or gels
Modified NIPAM hydrogels	✓	x	x	Printable or film formation
Phosphonium ionic liquids	x	✓	x	Printable or film formation
Nanocellulose	✓	x	✓ (Wound healing)	3D printable
Methacrylated hyaluronic acid (HAMA)	✓	x	x	Printable ink
Methacrylated chitosan (ChiMA)	✓	x	x	Printable ink
Methacrylated ulvan (UlvMA)	✓	x	x	Printable ink
Methacrylated gellan gum (Gellan Gum MA)	✓	x	x	Printable ink
Gellan gum RGD	✓	x	x	Printable ink

in 2016, this year has seen the development of an improved heterogeneous graphene-porphyrin electrocatalyst using the analogous water soluble iron porphyrin. This new catalytic system operates in water and has the potential to be scaled for commercial use.

Key to this catalyst development was the availability of the Generation 1 liquid crystalline graphene oxide (LCGO) dispersion that provided the

electroactive structural component for the composite catalyst by way of a facile water-based self-assembly process with the porphyrin. The ability of the LCGO aqueous dispersion to form a hydrogel, as previously reported, also allowed for further development of a 3D composite catalyst that was equally effective as a CO₂ reduction electrocatalyst but with the added advantage of having much higher surface area, a key requirement for

heterogeneous catalysts.

The use of graphene as an electroactive structural support for a variety of other catalysts for energy applications has also been explored. Synthetic Energy Systems (SES) researchers have shown that modification of the above graphene hydrogel approach to include a second 2D material such as molybdenum disulphide (MoS₂) has provided an exciting new composite electrode material for high performance lithium

ion batteries. A highly porous MoS₂/reduced graphene oxide (rGO) hydrogel can be formed by mixing an ACES developed aqueous MoS₂ dispersion with the LCGO dispersion. Freeze drying the resulting hydrogel retains the porous structure to give a high surface area electrode.

Similarly, carbon-coated hollow nickel phosphorous (Ni₁₂P₅) nanocrystals grown on rGO nanosheets have great potential for lithium/ sodium (Li/Na) storage as an anode material in batteries.

An antimony (Sb) nanosheet-graphene composite has been prepared by the simultaneous cathodic exfoliation of bulk Sb and anodic exfoliation of graphite. This combined 2D material shows a higher activity for CO₂ reduction than the individual materials themselves.

Nanocrystalline PdCu supported on

graphene has also proved to have a higher activity and be a more durable catalyst than the commercial palladium/carbon (Pd/C) catalyst for the formic acid oxidation reaction.

Combining graphene with other host structural materials facilitates fabrication as demonstrated by the formation of a variety of graphene composite fibres. These include high strength graphene and polyacrylonitrile composite fibres and superelastic hybrid carbon nanotube (CNT)/graphene fibres suitable for wearable energy storage applications.

Biopolymers have proven to be excellent host structural materials allowing the fabrication of a variety of 3D structures from graphene-based biocomposites as reviewed by ACES researchers in 2017. In addition, 3D printable conducting hydrogels containing chemically converted

graphene have been prepared and synthetic biosystem (SBS) researchers have fabricated porous 3D graphene-polydimethylsiloxane (PDMS) scaffolds that show improved osseointegration.

These graphene-based studies and applications highlight the importance of exploring both the tuning of the mechanical and electrical properties of previously developed ACES graphenes as well as new methods for their scalable production. In this regard, the use of ionic interactions to tune the mechanical and electrical properties of hydrated LCGO films has been demonstrated to be of benefit for the fabrication of LCGO structures. In addition, two new exfoliations of graphite have been developed by ACES researchers. A solid phase physical exfoliation enhanced with donor-acceptor molecules produces organic solvent dispersed graphene and a selective edge functionalisation

RESEARCH IN ACTION

CHEMICAL FUELS

Challenge: Energy efficient production of renewable fuels.

Solution: ACES has embarked on fundamental explorations that are providing the foundation for addressing some of today's most challenging global problems. Taking carbon dioxide (CO₂) and nitrogen (N₂) out of the air and converting them into fuels or other useful chemicals has the potential to both address sustainable energy production as well as climate change.

ACES has developed a number of highly effective catalysts that convert CO₂ to carbon monoxide (CO), an industrial gas used in the production of many bulk chemicals, syngas, a mixture of CO and hydrogen (H₂) used to make the fuel methanol, and formic acid, a cleaner, preservative and antibacterial agent. The current industrial production of carbon dioxide is highly energy intensive so an inexpensive electrochemical process that could produce methanol as a fuel, particularly if driven by solar energy would be an enormous advancement in sustainable energy production, particularly for transportation.

In a similar fashion, catalysts for the industrially important conversion of N₂ to ammonia (NH₃), a major industrial fertiliser and source of chemicals, have been developed in ACES. This is an exciting and burgeoning research area that has attracted significant industrial interest and discussions with ACES researchers on the commercial opportunities since ammonia is seen as an easily transportable and environmentally friendly liquid fuel for fuel cell usage.

Engagement: A number of aspects of this research have involved AIs Prof Alan Bond and Dr Chenghua Sun whose expertise has been vital in deciphering the complex mechanisms involved in these processes and understanding the role of dopants in novel catalyst structures. Commercialisation options have been discussed with True North Venture Partners, Renewable Hydrogen P/L, Siemens and Yara International.

Impact: This work has only been possible through ACES advances in electromaterials, which are central to the realisation of catalytically driven systems, as well as the control of the nano-micro-macro structure of the electrode itself that is critical to efficient electrode operation. The CO₂ work has been reported in 10 published or submitted publications and is the subject of a provisional patent application, while two provisional patents and an international PCT were filed by ACES researchers in 2016-17 on high-efficiency electrochemical conversion of nitrogen into ammonia, along with 3 significant publications in 2017.

of graphite affords remarkably high aqueous concentrations of a defect-limited graphene that is proving useful for composite development and fabrication. This edge functionalisation method is particularly suited to large scale graphene production.

Other nanocarbons have also been used to fabricate electrodes. The co-deposition of carbon dots and rGO nanosheets on carbon-fibre produced microelectrodes suitable for the selective detection of dopamine. A molybdenum carbide (Mo_2C) / carbon nanotube (CNT) composite material was developed as the cathode for high energy efficiency rechargeable Li-CO_2 batteries.

Nitrogen-doped carbons have also been developed for electrodes with a three-dimensional nitrogen-doped carbon framework fabricated for high performance sodium ion batteries and porous nitrogen-doped carbon derived from biomass for electrocatalytic reduction of CO_2 .

Nanodiamond has again proved useful when incorporated into polydimethylsiloxane based microfluidic devices and thin films by electrofluidic and diagnostic (EFD) researchers. The nanodiamond composite materials showed enhanced physicochemical properties, including the dispersion pattern, hydrophobicity, chemical structure, elasticity and thermal characteristics.

As discussed above, ACES SES researchers have increasingly explored the use of other 2D materials and metals for chemical fuel production (see Research in Action box). Thus, vertically aligned interlayer expanded MoS_2 nanosheets have been placed on a carbon support for hydrogen evolution electrocatalysis while hierarchical mesoporous tin dioxide (SnO_2) nanosheets have been put onto carbon cloth to give a robust and flexible electrocatalyst for CO_2 reduction that demonstrates high efficiency and selectivity.

Conducting polymers are also useful conductive substrates for 2D materials. A free-standing MoS_2 /poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT) film has proven valuable for supercapacitor applications. In this application area, ACES researchers have reviewed recent progress in the use of 2D materials for flexible supercapacitors.

Manganese oxide is still proving to be an attractive electrode material. Studies have been undertaken into tunable biogenic manganese oxides and their mineralisation. A $\text{MnO}_2/\text{MnCo}_2\text{O}_4/\text{Ni}$ heterostructure has been used in a bifunctional electrode architecture for urea oxidation.

A number of other metal oxides or sulphides have been fabricated into electrodes for energy applications with Co_3O_4 nanoneedle arrays as a multifunctional "super-reservoir" electrode for long cycle life lithium-sulphur batteries, CoS quantum dot nanoclusters for high-energy potassium-ion batteries, and a lead oxide derivative as an electrode for CO_2 reduction. SBS researchers have also been interested in metal oxide electrodes with iridium oxide being investigated for neural electrodes.

Metals such as gold (Au), bismuth (Bi), antimony (Sb), copper (Cu), palladium (Pd) and tin (Sn) have all been used as electrodes for electrochemical CO_2 or N_2 reduction, however it is the engineering of the metal or composite that is critical. For example, core-shell Cu/Au nanostructure arrays produce syngas, a mixture of CO and H_2 , from CO_2 , whereas Sn/ SnS_2 nanosheets efficiently reduce CO_2 to formate. In contrast, Sb is an effective reduction catalyst as a 2D material. Nanostructuring a gold/bismutite hybrid heterocatalyst leads to the plasmon-enhanced reduction of N_2 to ammonia. Pd nanocubes decorated with PdCu have platinum (Pt) like activity for the H_2 evolution reaction from water.

ACES SES researchers, with Spanish collaborators, have also shown that

conducting polymers can be useful for electrode materials, developing a PEDOT/lignin film that is suitable as a cathode for sodium batteries.

These softer conducting polymer electrode materials are of particular value for biomaterial interfaces. Thus, the development and functionalisation of polypyrrole films and scaffolds for cell growth and biocompatible actuators has been at the forefront of work in the SBS theme this year.

The use of biopolymers such as gelatin and collagen and synthetic hydrogels in bioinks and scaffolds for corneal regeneration was the subject of a major review on biomaterials for corneal bioengineering. Other uses of hydrogels that have been explored include novel use as edible electrodes.

It has been important to continue to study the properties of these hydrogel materials in order to best tailor the materials for applications such as bioinks. Thus, the electromechano responsive properties of gelatin methacrylate (GelMA) hydrogel on conducting polymer electrodes has been quantified using atomic force microscopy.

As a result of their proven value as electrolyte components, the development and study of ionic liquids (ILs) and the related organic ionic plastic crystals (OIPCs) has remained an area of research strength within ACES. Studies of functional electromaterials based on ferricyanide redox-active ILs and poly(IL) proton conducting membranes with phosphonium counter-cations have been undertaken. The effect of ions on IL electrolytes has been explored and IL-based membranes and electrolytes developed for zinc-based redox flow batteries, proton exchange membrane fuel cells as well as lithium ion and biodegradable magnesium batteries.

The importance of 3D fabrication to ACES research has been highlighted by developments across all of the ACES themes in 2017. The 3D printing of

RESEARCH IN ACTION

ELECTROSTATIC CATALYSIS

Challenge: Enhancing electrochemical reactions.

Solution: ACES and collaborators have shown that directional electric fields should be able to affect chemical reactions because most molecules are polar. However, such effects are strongly directional and controlling the orientation of molecules in the field is the big challenge. To solve this problem, scanning tunnelling microscopy (STM) was used to both hold the molecules in place, apply an electric field and measure the field's impact on their reaction rate (Nature 2016) demonstrating electric field catalysis. Following this discovery, in 2017, ACES has been exploring whether electrostatic effects can be harnessed in simpler systems such as electrochemical cells. Already the work has shown that electrostatic effects are often overlooked in standard redox chemistry, rewriting the rules by which charge-transfer at semiconductors is analysed. More generally, electrostatic effects help to drive otherwise unfavourable chemical reactions, which has widespread applications in electro-organic synthesis (2017 Nature Communications).

Engagement: ACES played a key role in bringing together the scientists with a common interest in this challenge and with the needed multidisciplinary skills, ranging from theory (ANU), synthesis (UOW) and STM (collaborators at Universitat de Barcelona).

Impact: The work has already been cited over 50 times in the first year and has sparked a new field of research. All of these results provide essential insights into how the reactivity of reaction centres might affect electric fields within electrochemical devices.

a variety of materials such as tough hydrogel composites (Soft Robotics (SR)), transparent and conductive heterogeneous hydrogel-elastomer composites (SR), human induced pluripotent stem cell constructs (SBS) and titanium conical arrays as TiO₂ electrodes for enhanced photoelectrochemical water splitting (SES), highlight the widespread applicability of this new approach to fabrication.

3D printing has been a key tool for EFD. One-step fabrication of microfluidic devices has been demonstrated. An LED photometric detector body with integrated slit was also 3D printed. In a similar fashion, other ACES researchers have used inkjet printing to create planar biochips as sensors for the electrochemical detection of biomolecules.

3D bioprinting was further progressed within ACES with the establishment of a team now charged with customised printer design, fabrication and assembly.

With the development of printing inks that are responsive to heat and hydration, the 4D printing of reversible

shape morphing hydrogel structures was achieved.

Fibre production continues to be a key technique for the 3D fabrication of electromaterials in ACES, as has been described above for graphene fibres. The torsional actuation of twisted nylon 6 fibres was further studied in Soft Robotics.

CHARACTERISATION

The objective of the ACES characterisation program is the development and use of innovative tools to map charge transfer and transport process in the 3D structures and devices created.

New tools such as ultrasound imaging of soft materials are under development with the validation of the program for ultrasound quantitative imaging completed in 2017 using the mechanical properties of hydrogels.

A variety of electrochemical techniques such as Fourier Transform Alternating Current Voltammetry (FTACV), have been utilised for characterising a diverse range of materials such as zeolitic imidazolate frameworks, the disulfide bond redox chemistry in

Escherichia coli HypD, and tin catalysts for the electrochemical reduction of CO₂.

The nuclear magnetic resonance (NMR) spectroscopy capabilities built up within the Centre have been utilised for the characterisation of many of the ACES-developed electromaterials. In particular, specialist NMR techniques have allowed the study of proton transport in hierarchical-structured Nafion membranes.

Similarly, ACES scanning microscopy capability has been used to probe the electrical and mechanical properties of electromaterial structures. Atomic force microscopy has been used to quantify the electromechano responsive properties of gelatin methacrylate (GelMA) hydrogel on conducting polymer electrodes and piezoresponse force microscopy used to probe the magnetoelectric properties of PVDF/Fe₃O₄ electrospun nanofibers.

MODELLING

ACES modelling research in 2017 has centred around building on the significant 2016 modelling achievements in quantum chemical

calculations on molecular systems, structural finite element modelling, density functional theory (DFT) modelling and molecular dynamics.

As described in the Electrostatic Catalysis Research in Action box, the 2016 ACES discoveries through modelling have sparked a new field of research in electrostatic catalysis and in 2017, ACES has been exploring whether electrostatic effects can be harnessed in simpler systems such as electrochemical cells. As a result, new effects have been uncovered at semiconductor interfaces. The modelling researchers have also demonstrated directionality and the role of polarisation in electric field effects on radical stability.

Molecular dynamics (MD) simulations have been used to study the interfacial behaviour of two ionic liquid (IL) systems that were previously tested by cyclic voltammetry and atomic force microscopy experimental measurements. While experimental tests revealed that the two ILs, 1-ethyl-3-methylimidazolium dicyanamide ([C2mim][dca]) and N-butyl-N-methylpyrrolidinium dicyanamide ([C4mpyr][dca]), significantly differed in their ability to support electrochemical cycling of zinc metal (i.e. deposition and stripping) on graphite, as well as in their interfacial structures (i.e. number and consistency of interfacial layers), the MD results indicated that the differences between these two ILs were apparent in several other features of their interfacial properties such as surface structure and layering disruption that could not be directly probed by any experimental techniques available to us. MD simulations have also been used to study the effect of tetraglyme plasticiser on dual-cation ionomer electrolytes.

SES battery researchers also used MD simulations to investigate the superoxide anion, $O_2^{\cdot-}$ in the oxygen reduction reaction to determine its average coordination number and dynamics in the ionic liquid electrolyte mixtures.

DFT modelling has been used in the SES theme to probe the heterogeneous catalysis mechanism of nitrogen reduction on various substrates. This was carried out with collaborators at Swinburne University and King Abdullah University of Science and Technology.

THEMES

As materials development, fabrication, characterisation, modelling, and structure and function studies have advanced over the last three years, the materials, methods and knowledge acquired has had a significant impact on the projects in the ACES application themes, Electrofluidics and Diagnostics (EFD), Synthetic Energy Systems (SES) and Synthetic Biosystems (SBS) and Soft Robotics (SR). Some of these impacts are described below as well as in the Research in Action boxes.

Ethics considerations are embedded in all materials development and fabrication and are reported on by ACES researchers at ACES meetings throughout the year. Specific Ethics, Policy and Public Engagement (EPPE) projects undertaken throughout 2017 in relation to prosthetic devices (SR), energy technologies (SES) and medical devices (SBS) are described below.

EFD: MULTI-MATERIAL AND COMPOSITE 3D PRINTED MICROFLUIDICS

Research throughout 2017 focused on the production and characterisation of new (functional) and 3D print compatible materials for application as or within microfluidic platforms/devices. Specifically, thermally conductive/electrically insulating composites, printable porous polymers for membrane and separation purposes, and fibre extrusion capability for new composites were developed. In addition, extensive in-house expertise in design was developed and 3D printing of complex microfluidic structures and platforms (multi-material flow cells, detector cells, separation columns,

in-chip membranes and separators etc.) was undertaken.

As a result, new disposable diagnostic chips for environmental pollutants, which incorporate a printed and selective internal membrane, were fabricated. Prototype high sensitivity 3D printed detection flow cells for flow analysis and chemiluminescence detection were developed, as well as new prototype detectors based upon LED light sources for application in portable microfluidic platforms. Collaboration with SES researchers led to a variety of new 3D printed cell designs to be tested and optimised for flow battery studies. See also Research in Action.

EFD: FIBRE BASED ELECTROFLUIDICS

In this project, the study and control of fluid movement upon and within fibres, natural and synthetic, functionalised and native, was undertaken. This has delivered new capability in sample handling, separation science and targeted delivery, most recently into and through hydrogels.

As a result of collaboration between ACES researchers at UTAS and UOW, novel fibres, composite fibres and functional fibres have been produced. In addition, 3D printed fibre fluidic platforms as simple diagnostic devices have been designed and developed, 3D printed platforms for the study of fibre based delivery into solid gels produced, and 3D printed electro-osmotic pumps based upon multi-fibre structures investigated.

The observations and fundamental developments in this project have provided new insights into the flow and control of fluids upon and within functional and composite fibres, through the control of an applied voltage. These new insights have seen the project grow into new areas, such as targeted drug delivery into hydrogels and several specific diagnostic assays based upon the fibre based systems have been developed in 2017.

RESEARCH IN ACTION

MICROFLUIDICS IN THREE DIMENSIONS

Challenge: Multifunctional 3D printed fluidic devices.

Solution: ACES researchers working within the Electrofluidics and Diagnostics theme, together with collaborators from across multiple ACES themes, have demonstrated the significant advantages to be exploited within the field of analytical microfluidics, via exploitation of state-of-the-art additive manufacturing technologies. This program of research has led to new printable composite materials for fluidic structures with enhanced thermal compatibility (2017 Scientific Reports), new approaches to 3D printing porous membranes and integrated reagents within 3D microfluidic devices, providing integrated sample isolation and detection capabilities (2017 Analytical Chemistry), and most recently provided new fundamental insights into chromatographic band diffusion and peak spreading in highly complex and tortuous 3D column designs, which were previously beyond the capabilities of traditional materials manufacturing (2017 Analytical Chemistry). Moving from channels to fibre based electrofluidics has also seen new capabilities developed in solute isolation, and delivery, including controlled delivery into and through hydrogels, with applications in targeted drug delivery now being explored (2017 Analytica Chimica Acta).

Engagement: This project has rapidly grown in scope and potential over the past year, with engagement between analytical scientists and chemical engineers (UTAS), material scientists and additive fabrication experts (UOW and DCU), medical scientists and biotechnologists (St Vincent's Hospital and UOW) and synthetic energy experts (Deakin).

Impact: A critical review on this subject by ACES PhD student Sidra Waheed (2016 Lab on a Chip) has already been cited 86 times, and sparked several new parallel projects in 3D printed composites materials for functional microfluidics. Advances have enabled new 'tailored' microfluidic platform development for targeted drug delivery and cell culture studies.

EFD, SBS: BRAIN-ON-A-CHIP (NEMO) CONCEPT

Following on from work in 2016 in which SBS researchers printed 3D structures that support the growth of brain-like tissue from human stem cells, research directions in this project during 2017 focused on iterations of the design and function of a generic 3D printed platform for the study of cell development under external stimulation.

The project links EFD and SBS themes and feeds off fundamental developments in microfluidics/ electrofluidics project. The aim is to provide a functional generic platform, based upon controlled movement of fluids throughout an integrated 3D system, to advance capability in the study and artificial stimulation of cells cultured within hydrogels.

SES: SOLAR FUELS

Advances in electromaterials are central to the realisation of catalytically driven systems that are at the heart of the production of solar fuels from

carbon dioxide (CO_2), nitrogen (N_2) and water. Control of the nano-micro-macro structures of the electrode itself is critical. To make the most of these efficient electrochemical processes requires the ability to transport reactants to and products from reaction sites. Drawing on knowledge accrued in the area of fluidics, we are now poised to achieve optimal CO_2/N_2 reduction systems. Research in the ACES solar fuels projects in 2017 has focused on the design of novel electrocatalysts by two-dimensional (2D) engineering of the bulk materials for CO_2/N_2 reduction and the development and characterisation of dye sensitised photocathodes for hydrogen (H_2) generation from water.

As highlighted earlier, the development of structured molecular and metal catalysts as well as graphene composite catalysts has led to outstanding outcomes in the electrochemical reduction of CO_2 to carbon monoxide (CO) and formate, and N_2 to ammonia (NH_3). These results lay the groundwork for future practical device development. See also Research in Action.

SES: BATTERIES

Two battery technologies have primarily been explored in 2017, high energy density redox-flow and sodium (Na)-oxygen devices. In both projects, ionic liquids (ILs) have been key electrolyte components.

In the redox-flow batteries, the development of zinc (Zn) based anodes for flow geometries employing high concentration electrolytes to enhance safety and energy density has been a focus. Higher concentration dicyanamide-based ILs were formulated (18 mol Zn(dca)2%) to increase the energy density. Electrochemical testing showed higher peak current densities and more positive Zn electrodeposition potentials, coupled with higher cycling efficiency, could be obtained for high Zn concentration systems, compared to those obtained with the lower Zn concentration system. This improved performance with higher Zn^{2+} target ion concentration supports the design of high energy density flow system concepts. In collaboration with ACES UTAS researchers, 3D printed flow cell

test reactors were designed and printed supporting new capability and prototype design.

In the sodium-oxygen battery research, the focus was on developing understanding of the oxygen (O_2) electrode processes in the IL electrolytes, which were shown to support good Na electrode cycling. The role of Na salt concentration in shifting electrolyte speciation and the O_2 redox mechanism was investigated while continuing to develop understanding and methodology to characterise discharge products in advanced 3D nanostructured electrodes. A novel 3D printed electrochemical 'air' cell allowing high quality measurements and post cycling characterisation of electrodeposits was designed and tested and prototype coin-cell Na-oxygen devices were tested incorporating ACES developed carbon air cathode electromaterials and commercial electrodes.

SES: THERMOCELLS

Following the significant breakthroughs made in the development of ionic liquid-based thermocells in 2016, research directions focused on two aspects, (i) exploration of new redox couples in order to increase the Seebeck coefficient, and (ii) strategies to develop quasi-solid state electrolytes.

The Seebeck coefficient, electrochemical behaviour and thermocell performance of a range of new cobalt-based complexes were investigated in order to study the effect of ligand structure on thermocell function. The best performance was achieved with the redox couple containing the ligand 2-(1H-pyrazol-1-yl)pyridine ($Co^{2+/3+}(py-pz)_3$) as a result of its large Seebeck coefficient, relatively fast diffusion and high ionic conductivity. The relationship between redox couple radius and Seebeck coefficient was also investigated and the nature of the ligand was found to significantly influence electrochemical reversibility, diffusion rate, Seebeck

coefficient and thermocell performance.

The development of polymer film electrolytes (which are less thermally conducting due to limited convection) have allowed the use of electrolyte films as thin as 1 mm. This has helped to overcome mass transport limitations and also decrease the amount of expensive electrolyte needed for the thermocell.

Large flexible 'pouch cell' thermocells using the facilities at BatTriHub (Deakin) were also trialled, requiring new electrode material (i.e. not platinum), sealing techniques, large spacers etc as well as new testing regimes. The pouch cell gave about 25 mW/m^2 for a temperature change (ΔT) of approximately 17°C , but its lifetime is still a problem. This work was primarily funded by a Deakin University Institute of Frontier Materials impact grant, in addition to ACES.

SR: SOFT ROBOTIC HAND

Research on this theme in 2017 has focused on mechanical design optimisation and 3D fabrication (by using 3D printing) of functional robotic prosthetic hands. A functional soft robotic prosthetic hand, capable of posing different gestures controlled by myoelectric signals, has been developed by using a new generation of assembly and fabrication technology (additive manufacturing) for both rigid and soft components. The hand palm is produced by using 3D printing technology with ABS filament and the digits (fingers and thumbs) are produced by using 3D printing technology with filaflex filament. The digits are actuated by three servo motors pulling tendons. Arm muscle activities, detected by a wireless myoelectric armband, are analysed for pattern recognition to control the gestures of the robotic prosthetic hand.

SR: ACTUATION

Novel actuation systems that can be used in soft robotic applications such as soft prosthetic hands, soft robots,

soft grippers and artificial muscles have been explored in SR. This has involved investigating thermal actuation concepts as well as 3D printed soft actuators.

The thermal actuation of an ionically and covalently crosslinked composite hydrogel of PNIPAm, alginate and carbon nanofibres has been investigated. The nanofibres provide considerable strength to the actuator, which thermally actuates in the range of seconds, a step towards real applications for artificial muscles.

A flexible commercial thermoplastic polyurethane (TPU) known as NinjaFlex has been used to 3D print actuators. The actuators were modelled and simulated in the ANSYS software package and their behaviour predicted accurately in terms of deformation and blocked force. Numerous experiments proved that the actuators could be used in soft robotic applications and, as a result, a three finger soft gripper, a walking robot, a hopping robot, an artificial soft muscle and modular soft actuators were successfully fabricated. The actuators can achieve bending motions, which allow them to be used in soft prosthetic hands.

SBS: 3D PRINTING STEM CELLS

Using protocols developed previously for printing human neural stem cells into 3D structures, protocols for developing 3D printed structures incorporating induced pluripotent stem cells (iPSC) have been optimised. Cells can be printed with high viability and differentiated into different neural subtypes.

SBS: INTERGRATING 3D NEURAL NETWORKS

Using 2D multielectrode arrays (MEAs) the firing patterns from 2D and 3D assemblies of neuronal cells have been obtained and significant differences observed; the recordings from the 3D systems being much more akin to those obtained *in vivo*.

SBS: NEURALLY DRIVEN PROSTHETICS

A monolithic soft hand replica, whose movement is manipulated through wearable electrodes, has been created using 3D printing. Sensing technologies based on printable electromaterials that enable feedback from the hand have been identified. Centre of Excellence funding now enables us to embark on a bold initiative. Drawing on expertise from SBS, electromaterials capable of effective interfacing with nerve and/or muscle cells will be identified and signals coupled to enable neurally driven control of the soft robotic hand.

EPPE: CHALLENGING ASSUMPTIONS ABOUT DISABILITY, THERAPY AND ENHANCEMENT

Research directions in this project during 2017 focussed in two areas: understanding how assumptions about disability and therapy shape research related to implanted neural devices and exploring possibilities for involving people with disability in the design of prosthetic limbs.

Conceptual developments have involved:

- understanding the relationships among disability and narratives of agency and identity in discussing neural technologies and prosthetics.
- understanding disability and technologies from the perspectives of those who have live experience of disability and of those designing the technologies (ethically assessing how best to engage prosthetic users in design)
- understanding how neural implants and development of a “brain on a bench” challenge identity and agency.

Collaborations with device designers have taken place with industry discussions with Cerebral Therapeutics and Medtronic about ethical/regulatory issues in device/prosthetic design. EPPE researchers have also designed and administered a survey on ‘What users want from a prosthetic hand’ in collaboration with SR researchers.

EPPE: ENGAGING KEY STAKEHOLDERS IN RENEWABLE ENERGY TECHNOLOGIES

The development of linkages was a focus of research in this project along with the extension of research on corporate social responsibility to address the challenges of conflict minerals and peacebuilding in the development of renewable energy technologies.

Conceptual developments have involved sustainable development goals and corporate social responsibility. This has been achieved by drawing on the United Nation’s sustainable development goals to provide a framework for assessing efforts at developing renewable energies that attend to the complex interactions between the challenge of scaling up renewable energy in developing nations and the goals of peacebuilding and disaster resilience.

In addition, the critique of “big energy” has been expanded by extending the critique of corporatised energy distribution and potential avenues for more socially responsible and sustainable approaches for renewables identified.

A wide range of national and international non-governmental organisation (NGO) and government

discussions have taken place including with AusNetServices, Indian entities such as the Centre for Responsible Business, Habitat Centre and a solar start-up Rural Spark, and the Bolivian representatives, Adrian Samfest of the German Embassy and the Dutch-Bolivian Chamber of Commerce and Industry.

EPPE researchers at Deakin also collaborated with researchers around the world, developing a video discussion on the effect of new age batteries for a low carbon future (<https://youtu.be/TQ46SCbC8lQ>).

EPPE: CHALLENGES FOR REGULATION AND CLINICAL APPROVAL OF PERSONALISED MEDICINE AND BESPOKE DEVICES

Research directions in this project during 2017 focussed on identifying new regulatory, IP and patent issues that arise from 3D printed medical technologies and Food and Drug Administration (FDA) approval of personalised devices.

An approach for articulating the legal issues raised for patents by bioprinting has been developed. In addition, a conceptual framework for distinguishing different kinds of personalisation or tailoring of medical implants and prostheses has been constructed to assist in identifying epistemic challenges. These include patient specific devices, devices that can be altered for particular patients and devices designed with patient material.

Ethical issues associated with patent exclusions in 3D bioprinting, legal issues in allocation of liability for risk in 3D printed products and IP issues in 3D printing have all been identified.

Publications

Publishing ACES research is essential for knowledge translation. Publishing both in academic journals and explaining the potential impact of that research to our community through our website portal provides an important means in which we disseminate the body of ACES knowledge.

ACES RESEARCH OUTPUTS - HIGH QUALITY INTERNATIONAL STANDING

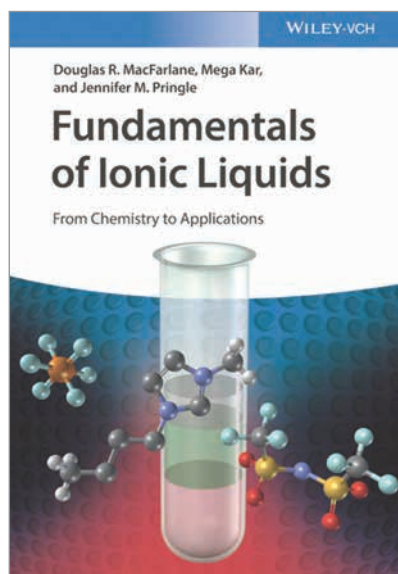
In 2017, 190 articles (based on SCOPUS data 9.1.18) were published that have ARC Centre of Excellence for Electromaterials Science in the address line hence indicating ACES members' involvement in that research.

The overall publication and citation activity for ACES affiliated 2017 and 2014-2017 publications (source, Scival based on SCOPUS data 9.1.18) is shown in Table 3. Please note that not all publications listed in Scopus (190) are available in SciVal database on 9.1.18 (179).

BOOK

Douglas R. MacFarlane, Mega Kar, Jennifer M. Pringle "Fundamentals of Ionic Liquids: From Chemistry to Applications" Wiley, 2017, ISBN: 978-3-527-33999-0. (2017)

Ionic liquids research was brought to the forefront of the media with ACES CI MacFarlane achievement award for his discovery and research on ionic liquids (salt compounds that are liquid at or around room temperature) that has resulted in major advances in technologies including solar cells and



energy storage. The book covers this area of research.

Reflecting on his research Prof MacFarlane said the extended Ionic Liquids group at Monash - which has included ACES Chief Investigator's Maria Forsyth, Jenny Pringle and Pat Howlett, as well as Prof's Glen Deacon, Keith Murray, Stuart Batten and Katya Pas - were very much part of the origins of the field of ionic liquids as we know it today.

"We understood at the time that they had unique and very powerful properties (and filed some of the first patents in the field), but we had no idea just how broadly applicable they would become. We adopted an open lab policy that had many visitors passing through and sent off samples around the world."

The field of ionic liquids is still expanding rapidly as new properties and new applications are discovered.

BOOK CHAPTERS

ACES members published 7 book chapters in 2017.

1. Ralph, N. and E. Kennedy (In Press). (2017) Stakeholder Engagement and Corporate Peacemaking. In P. Molthan-Hill (Ed) The Business Student's Guide to Sustainable Management (UK: Greenleaf Publishing)
2. A Quigley, J Bourke, R Kapsa, (2017) CRC Press – Taylor and Francis Group -'Electrical Stimulation of Cells Derived from Muscle', in book 'Conductive polymers: Electrical interactions in cell biology and medicine', (2017)
3. Crook JM, Tomaskovic-Crook E, Ludwig TE. Cryobanking Pluripotent Stem Cells. Methods in Molecular Biology. Vol 1590: Humana Press Inc.; 2017:151-164.
4. Crook JM, Tomaskovic-Crook E. Culturing and Cryobanking Human Neural Stem Cells. Methods in Molecular Biology. Vol 1590: Humana Press Inc.; 2017:199-206.
5. Crook JM, Kravets L, Peura T, Firpo MT. Derivation of Human Embryonic Stem Cells. Methods in Molecular Biology. Vol 1590: Humana Press Inc.; 2017:115-129.
6. D. L. Officer, Klaudia Wagner, Pawel Wagner, in Conductive Polymers. Electrical Interactions in Cell Biology and Medicine, Chapter 3, 1st ed. (Eds.: Z. Zhang, M. Rouabhia, S. E. Moulton), CRC Press, Boca Raton, Florida, United States, 2017, pp. 42.
7. Naficy S, Spinks GM, Baughman RH. Chapter 13: Bio-inspired Polymer Artificial Muscles. In: Kilbinger AFM, Tang BZ, Bruns N, eds. RSC Polymer Chemistry Series. Vol 2017-January: Royal Society of Chemistry; 2017:429-459.

SPECIAL JOURNAL

ACES CI Hancock, Deakin University, was a guest editor on the Special

Table 3: Overall publication and citation activity for ACES affiliated publications 2014-2017
(Source, Scival based on SCOPUS data 9.1.18)

	2017	2014-2017
Number ACES publications (SCOPUS)	190	745
Number of ACES publications (SciVal)	179	722
Number of subject areas (main categories) ACES published in	19	22
^^ Views count	3,458	29,117
^Views per Publication (articles and reviews)	20.1	42.5
Outputs in Top 1% of world views	14 (7.8%)	68 (9.4%)
Outputs in Top 10% of world views	76 (42.5%)	399 (55.3%)
Outputs in Top 25% of world views	123 (68.7%)	584 (80.9%)
Number of citations	198	7,345
Number of citing countries	42	90
Average citations/ publication	1.2 (72 cited publications)	11.0 (540 cited publications)
Outputs in top 1% most cited	9 (5.0%)	48 (6.6%)
Outputs in top 10% most cited	74 (41.3%)	293 (40.6%)
Outputs in top 25% most cited	179 (100%)	556 (77%)
Field Weighted Citation Impact (#FWCI - for articles and reviews)	1.57	1.84
International collaboration	103 (57.5%)	398 (55.1%)
National collaboration	60 (33.5%)	256 (35.5%)

Legend:

^^ **Views count:** Total views received by publications of the selected entities (Source: SCOPUS data)

^ **The average number of views per publication** (Source: SCOPUS data)

The Field Weighted Citation Impact (FWCI) World Average is 1.00.

Volume of the Journal of Environmental Accounting and Management (JEAM): "Sustainability as a Strategy for the Commons". In accordance with the high academic standards promoted by the JEAM, this worldwide call of papers for the Indian and Sustainability

Standards Conference was focused upon but is not limited to the following themes: Progress in Cleaner Production and Technical Processes; Sustainable Development and Sustainability: How Should they be Interconnected?; Sustainable Consumption: Integral

to Essential Societal Transitions; Environmental and Sustainability Assessments of Societal Transitions; Sustainable Products and Services; Corporate Sustainability and Corporate Social Responsibility; Education for Sustainable Development;

Governance, Legislation, and Policies and Development and Growth - their implication on Sustainability. Publication of the special volume of all accepted papers is anticipated for 31st May 2018.

Mary Walker, ACES Research Fellow at Monash University, guest-edited an issue of *Journal of Medicine and Philosophy* on 'The Boundaries of Disease' (with Wendy Rogers).

JOURNAL ARTICLES

It is pleasing to note that a critical review 'Multifunctional 3D printed fluidic devices' by ACES PhD student Sidra Waheed (*Lab on a Chip*, 2016) has already been cited 86 times, and has sparked several new parallel projects in 3D printed composites materials for functional microfluidics. Advances have enabled new 'tailored' microfluidic platform development for targeted drug delivery and cell culture studies.

The artwork from the ACES article '3D Bioprinting Human Induced Pluripotent Stem Cell Constructs for In Situ Cell Proliferation and Successive Multilineage Differentiation' highlighted the cover of *Advanced Healthcare Materials* and the research behind it. In the article ACES CIs Jeremy Crook and Gordon Wallace, and co-workers at ACES, introduce a novel tissue engineering method involving 3D bioprinting of human induced pluripotent stem cells. Their approach creates cell-laden constructs with the capacity to form ectodermal, endodermal, and mesodermal tissues (exemplified by neuronal, lung, and muscle cells) and therefore all tissues of the body.

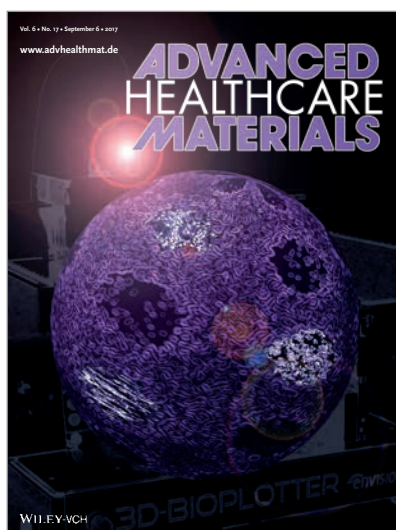
2017 ACES JOURNAL PUBLICATION LIST

The 2017 ACES publication list below is reported in order from highest impact factor of the journal.

1. Zhou F, Azofra LM, Ali M, Kar M, Simonov AN, McDonnell-Worth C, Sun C, Zhang X, MacFarlane DR. *Electro-synthesis of ammonia from*

nitrogen at ambient temperature and pressure in ionic liquids. *Energy and Environmental Science.* 2017;10(12):2516-2520. IF= 29.518.

2. Zhang L, Kim T, Li N, Kang TJ, Chen J, Pringle JM, Zhang M, Kazim AH, Fang S, Haines C, Al-Masri D, Cola BA, Razal JM, Di J, Beirne S, MacFarlane DR, Gonzalez-Martin A, Mathew S, Kim YH, Wallace G, Baughman RH. *High Power Density Electrochemical Thermocells for Inexpensively Harvesting Low-Grade Thermal Energy.* *Advanced Materials.* 2017;29(12). IF= 19.79.
3. Tian K, Bae J, Bakarich SE, Yang C, Gately RD, Spinks GM, in het Panhuijs M, Suo Z, Vlassak JJ. *3D Printing of Transparent and Conductive Heterogeneous Hydrogel-Elastomer Systems.* *Advanced Materials.* 2017;29(10). IF= 19.79.
4. Wright B, Nakajima Y, Clarke TM, Okuda K, Paananen H, Mozer AJ, Mori S. *Quantifying Recombination Losses during Charge Extraction in Bulk Heterojunction Solar Cells Using a Modified Charge Extraction Technique.* *Advanced Energy Materials.* 2017;7(11). IF= 16.72.
5. Wagner K, Tiwari P, Swiegers GF, Wallace GG. *Alkaline Fuel Cells with Novel Gortex-Based Electrodes are Powered Remarkably Efficiently by Methane Containing 5% Hydrogen.*



Advanced Energy Materials. 2017. IF= 16.72.

6. Lu Z, Foroughi J, Wang C, Long H, Wallace GG. *Superelastic Hybrid CNT/Graphene Fibers for Wearable Energy Storage.* *Advanced Energy Materials.* 2017. IF= 16.72.
7. Lu J, Jiang L, Li W, Li F, Pai NK, Scully AD, Tsai CM, Bach U, Simonov AN, Cheng YB, Spiccia L. *Diammonium and Monoammonium Mixed-Organic-Cation Perovskites for High Performance Solar Cells with Improved Stability.* *Advanced Energy Materials.* 2017;7(18). IF= 16.72.
8. Lee CY, Taylor AC, Beirne S, Wallace GG. *3D-Printed Conical Arrays of TiO₂ Electrodes for Enhanced Photoelectrochemical Water Splitting.* *Advanced Energy Materials.* 2017;7(21). IF= 16.72.
9. Ganesan A, Coote ML, Barakat K. *Molecular 'time-machines' to unravel key biological events for drug design.* *Wiley Interdisciplinary Reviews: Computational Molecular Science.* 2017;7(4). IF= 14.016.
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11. Menzel JP, Noble BB, Lauer A, Coote ML, Blinco JP, Barner-Kowollik C. *Wavelength Dependence of Light-Induced Cycloadditions.* *Journal of the American Chemical Society.* 2017;139(44):15812-15820. IF= 13.858.
12. Li Y, Haworth NL, Xiang L, Ciampi S, Coote ML, Tao N. *Mechanical Stretching-Induced Electron-Transfer Reactions and Conductance Switching in Single Molecules.* *Journal of the American Chemical Society.* 2017;139(41):14699-14706. IF= 13.858.

13. Li F, Chen L, Xue M, Williams T, Zhang Y, MacFarlane DR, Zhang J. *Towards a better Sn: Efficient electrocatalytic reduction of CO₂ to formate by Sn/SnS₂ derived from SnS₂ nanosheets*. Nano Energy. 2017;31:270-277. IF= 12.343.
14. Ghosh SK, Adhikary P, Jana S, Biswas A, Sencadas V, Gupta SD, Tudu B, Mandal D. *Electrospun gelatin nanofiber based self-powered bio-e-skin for health care monitoring*. Nano Energy. 2017;36:166-175. IF= 12.343.
15. Zong Y, Zheng T, Martins P, Lanceros-Mendez S, Yue Z, Higgins MJ. *Cellulose-based magnetoelectric composites*. Nature Communications. 2017;8(1). IF= 12.124.
16. Vogel YB, Zhang L, Darwish N, Gonçalves VR, Le Brun A, Gooding JJ, Molina A, Wallace GG, Coote ML, Gonzalez J, Ciampi S. *Reproducible flaws unveil electrostatic aspects of semiconductor electrochemistry*. Nature Communications. 2017;8(1). IF= 12.124.
17. Lin X, Jumabekov AN, Lal NN, Pascoe AR, Gómez DE, Duffy NW, Chesman ASR, Sears K, Fournier M, Zhang Y, Bao Q, Cheng YB, Spiccia L, Bach U. *Dipole-field-assisted charge extraction in metal-perovskite-metal back-contact solar cells*. Nature Communications. 2017;8(1). IF= 12.124.
18. Hou Y, Wang J, Liu L, Liu Y, Chou S, Shi D, Liu H, Wu Y, Zhang W, Chen J. *Mo₂C/CNT: An Efficient Catalyst for Rechargeable Li-CO₂ Batteries*. Advanced Functional Materials. 2017;27(27). IF= 12.12.
19. Gu Q, Tomaskovic-Crook E, Wallace GG, Crook JM. *3D Bioprinting Human Induced Pluripotent Stem Cell Constructs for In Situ Cell Proliferation and Successive Multilineage Differentiation*. Advanced Healthcare Materials. 2017;6(17). IF= 12.12.
20. Gao H, Zhou T, Zheng Y, Zhang Q, Liu Y, Chen J, Liu H, Guo Z. *CoS Quantum Dot Nanoclusters for High-Energy Potassium-Ion Batteries*. Advanced Functional Materials. 2017;27(43). IF= 12.12.
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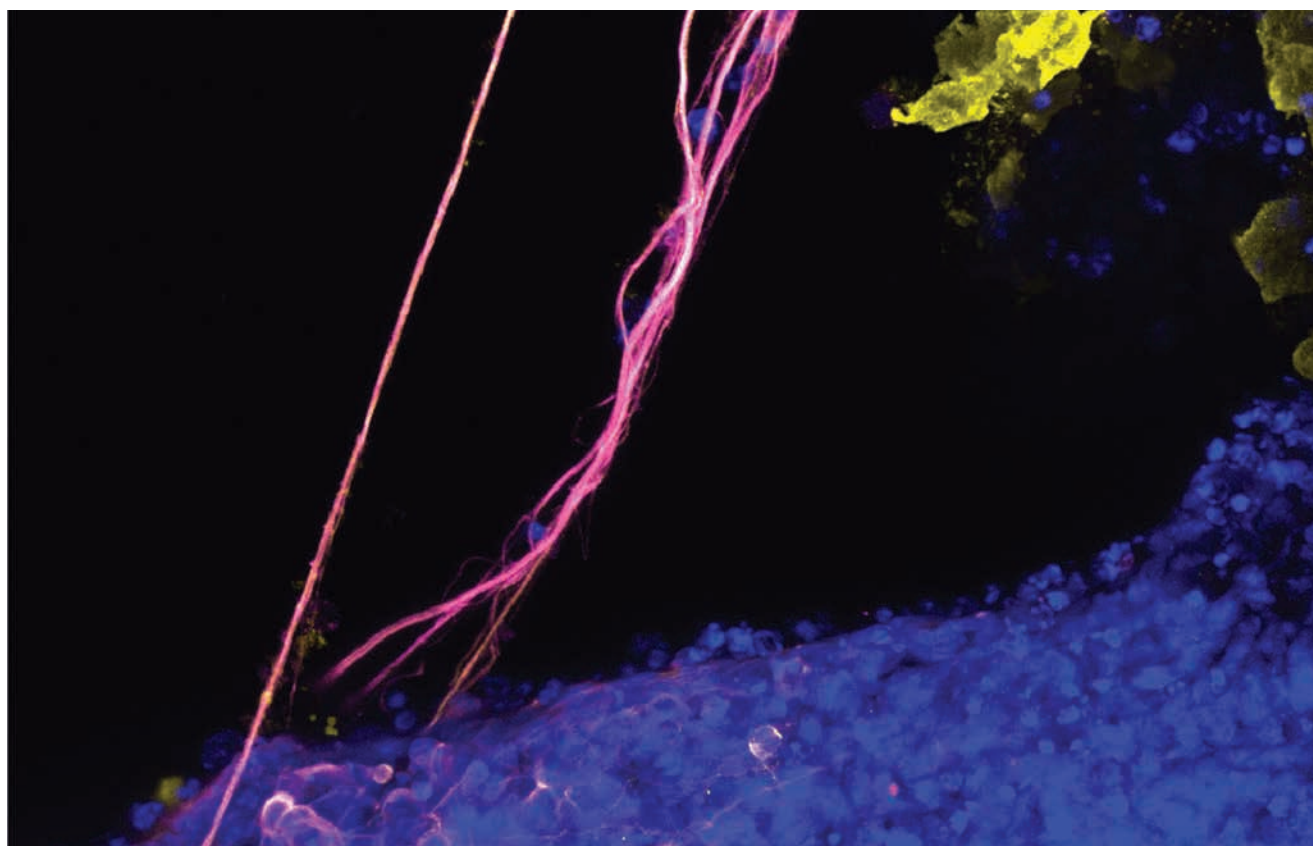
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CONFERENCE - FULL WRITTEN PAPER-REFEREED PROCEEDINGS

1. Hamilton, G. Alici, G. Spinks, and M. in het Panhuis, "The Suitability of 3-D Printed Eutectic Gallium-Indium Alloy as a Heating Element for Thermally Active Hydrogels", MRS Advances, Vol.2, No. 6, DOI: 10.1557/adv.2016.618, pp. 335-340, 2017
2. S. A. Bonke, A. M. Bond, L. Spiccia, A. N. Simonov "Parametrization of

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3. T. D. Than, G. Alici, H. Zhou, S. Harvey, and W. Li, "Enhanced Localization of Robotic Capsule Endoscopes Using Positron Emission Markers and Rigid-Body Transformation", IEEE Transactions on Systems, Man and Cybernetics: Systems, DOI: 10.1109/TSMC.2017.2719050, June 2017
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7. Cabot, JM; Breadmore, MC; and Paull, B, "Fibre based platforms for direct analysis of metabolites in complex samples", Proceedings of the 21th International Conference on

Miniaturized Systems for Chemistry and Life Sciences (microTAS), 22-26 October 2017, Savannah, USA.

8. Feng Li, Niall P. Macdonald, Rosanne M. Guijt, Michael C. Breadmore, "Printing orientation influences fluidic behaviour in channels made by fused deposition molding", Proceedings of the 21th International Conference on Miniaturized Systems for Chemistry and Life Sciences (microTAS), 22-26 October 2017, Savannah, USA.
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10. Niall P. Macdonald, Sinéad Currivan, Brett Paull and Michael C Breadmore, "3D branching structures for fluidic proportioning and sample handling", Proceedings of the 21th International Conference on Miniaturized Systems for Chemistry and Life Sciences (microTAS), 22-26 October 2017, Savannah, USA.

CONFERENCE REFEREED ABSTRACTS

1. Hancock, L and N Ralph (2017) 'Big Energy and the Political Economy of Energy Policy in Australia: Future High Voltage Superpower or Backwater State?'. Paper presented at the International Studies Association (ISA) 'Understanding Change in World Politics', 58th Annual Convention, Baltimore, United States, 22-25 February.

Research Training

ACES STRATEGIC PLAN GOAL 2: RESEARCH TRAINING

Our goal is to deliver innovative research training and mentoring programs that ensure the development of world-class graduates and early career researchers with excellent research skills as well as science communication, research management and commercialisation skills, coupled with an ethical awareness of the impacts of their scientific endeavour.

Our target audience is primarily prospective students. ACES provides an inclusive and supportive global research training opportunity; giving access to the most innovative and dynamic research training programs that are facilitated by our global connections.

TOWARDS OUR GOALS

"In Australia, we find ourselves well placed to build interdisciplinary teams to tackle big challenges. I have no doubt they will deliver more in the next five years than in the last thirty", states ACES Director Prof Wallace.

Within ACES researchers are being trained differently. They are trained to be at the forefront of their craft from a technical perspective, but also highly trained communicators capable of extending across the traditional boundaries found in science and engineering. Beyond that they are trained to be commercially aware, to recognise ethical and regulatory issues that might need to be addressed to ensure the real impact of fundamental discoveries is delivered to those that can use them.

ENTREPRENEURSHIP & INNOVATION CERTIFICATE

ACES, in collaboration with the Sydney Business School, developed the 'Certificate in Entrepreneurship and Innovation (E&I)'. We aim to challenge our young researchers by encouraging them to maximise end-user engagement and consider commercial opportunities through completing the E&I certificate.

Led by ACES CI Mozer and Dr Tillmann Boheme from Sydney Business School, a group of twenty nine participants commenced the certificate in October.

The course started with an intensive one week overview on entrepreneurship and innovation. Lecture topics included:

- 'What is innovation?'
- Defining entrepreneurship
- Innovation: a core business strategy building the innovative organisation

Expert tuition was given from the Sydney Business School and industry professionals, plus each group was assigned mentors for the technical aspects of their project.

This program has been developed to place ACES projects in a business context with a commercial lab based opportunity; culminating with each group giving a feasibility pitch at the conclusion of the program.

The strength of this ACES training program is that we take real world challenges or problems and find not only the technical but the business solutions to these challenges.

POST GRADUATE SECTION RUNNER UP - 2017 UOW PITCH COMPETITION

ACES affiliate and ARC Steel Hub PhD student Dan Yang, participant in the E&I certificate, used skills learnt to great advantage - awarded Runner

Up in the post graduate section of the 2017 UOW Pitch competition in October. Dan's pitch was 'Protective Clothes for Teeth - an invisible but powerful protective coating of functionalised silica dioxide nano particles to prevent the formation of dental plaque'.

The UOW Pitch competition promotes student and staff involvement in entrepreneurialism and the commercialisation of ideas, inventions and research outcomes at UOW.

ACES COMMUNICATIONS

Science in Public (Niall Byrne) conducted a science communications course for ACES (20 members).

Delivered over two days (27 March and 24 July) the course involved:

- (a) Meeting your audience: a 90 minute moderated discussion forum where participants started thinking about how they could talk with the media and other stakeholders about their research. Panelists were:
 - Bridie Smith (Science Reporter for 'The Age')
 - Alicia McMillan (Weekend Chief of Staff at Channel 7, who also lectures in journalism at Monash University)
 - Misha Ketchell (Managing Editor of 'The Conversation', who has worked at Crikey and Media Watch)
- (b) Making and delivering a one minute pitch for feedback.

Over the four months between sessions each attendee was required to write a piece targeted to the Conversation as well as prepare a one minute video about their research. Feedback on their videos and conversation pieces was given by:

- Misha Ketchell (Editor, 'The Conversation')



- Mel Clarke (ABC Political Reporter)
- Brigid O'Connell (Health Reporter, Herald Sun)

ACES UTAS RF Niall Macdonald, entered his video '3D printed microfluidic chips in 2 mins' into the Dolomite video competition.

ACES UOW RF Andres Ruland has his video 'Basic ultrasound imaging for tissue engineered constructs' on the ACES YouTube channel (https://www.youtube.com/watch?v=s23_d-qeEn4)

THREE MINUTE THESIS PARTICIPATION

ACES encourages our PhD students to enter three minute thesis competitions to assist them with communicating their research in a means suitable for a general audience.

ACES affiliate and ARC Steel Hub PhD student, Brianna Knowles, won the UOW competition and went on to represent UOW at the Three Minute Thesis (3MT®) Asia-Pacific Final, held at The University of Queensland 29 September. Her presentation 'Just add water' showcased her research into prevention of biofouling.

ACES PhD student Daniela Duc, from Swinburne University of Technology,

delivered her three minute thesis presentation, 'Fabrication of Electrical and Optical Cell Co-Stimulation Materials', at the Australian Society for Medical Research Victorian Student Symposium, 1 June.

ACES PhD student Jun (Rossie) Rao was runner up in the 3MT within the Institute for Frontier Materials at Deakin University in June.

SHORT COURSES CAN BOOST SKILLS FOR RESEARCH STUDENTS AND PROFESSIONALS

The use of training tools such as Massive Open Online Courses (MOOCs) and short courses undoubtedly add agility to on going training options.

ACES and ANFF (Materials Node) staff produced an eight hour (two hours per week for four weeks) MOOC on Bioprinting. The Bioprinting MOOC is now in its 7th run and we are pleased that 25,114 people have joined and learnt more about the revolution in medicine that 3D bioprinting is making possible.

The first MOOC run attracted the most participants (7,000 registrations), with 26% from the United Kingdom, 9% from the United States, and 8% from

Australia. Participants in subsequent runs ranged between 1,300 and 3,600 except for a higher than average enrolment (6,557 participants) for run five (13 February 2017). Run five followed a visit to Dubai, arranged through Department of Foreign Affairs and Trade (DFAT), in January by Prof Wallace.

For the most recent MOOC (started 18th September) participants heard from Ear Nose and Throat (ENT) surgeon Dr Payal Mukherjee who is working with ACES researchers to help patients with Microtia.

Apart from the biomedical engineers and scientists, another critical member of the research team is, of course, the clinician, who identifies the actual need for the use of a 3D printed structure to solve a medical condition.

Clinicians collaborating with the ACES team include: Prof Peter Choong from St Vincent's Melbourne (cartilage development from stem cells and the biopen), Prof Toby Coates (printed structures to facilitate islet cell transplantation), Dr Stuart MacKay (printed structures to understand airway collapse and prevention), Dr Chris Baker (wound healing) and Dr Gerard Sutton (corneal regeneration)

MY STORY

JOANNE WILLIAMS - BIOFABRICATION MASTERS STUDENT

I attended the first Bill Wheeler award event in 2009, with my 4 month old baby boy, Felix, strapped to my chest in a baby carrier. He was born profoundly deaf and we were here to see Prof Graeme Clark speak and hoped to meet him. This man who was responsible for the cochlear implants Felix was scheduled to receive in only a few weeks' time - these devices were our hope for his future by then.

I returned to ACES in 2011 to the Bill Wheeler event again to see Prof Clark with Felix who had successfully by then had his implants.

Once Felix started school, I decided I didn't want to go back to my IT career. I wanted to make a difference. I met with Gordon Wallace, and applied for a Masters of Biofabrication - possibly as about the least typical masters student you could imagine, but with a sense of purpose and the passion to follow through. 3D printing promised so much and I hoped it could help improve cochlear implants in some way.

So here I am, full circle, on the receiving end of the Bill Wheeler student prize. I wouldn't have thought it possible 8 years ago but I do believe I'm on the path to making a difference and am receiving this award from others who also want to help make that difference. This is an exciting place to be, the people and their support are amazing, the facilities are world class.

With this prize, I'd like to travel to the new Graeme Clark Institute for Biomedical Engineering at the University of Melbourne. There, research is progressing in drug delivery devices, 3D printing and personalised implants. There is a real focus on clinical solutions.

and now Dr Payal Mukherjee (microtia).

5241 participants have successfully completed the MOOC (21% of all enrolled participants). While the MOOC was aimed at a community level of understanding, it demonstrates the power of the medium to connect with a diverse range of individuals. On each run the majority of individuals taking part were from the age bracket 18-35, with a high level of interest from those aged 36-45.

ACES members also gain experience moderating the online forums for the MOOC.

MASTERS TRAINING PROGRAM IN BIOFABRICATION

The MOOCs were run alongside the more formal qualification course of the Masters in Philosophy (Biofabrication). This world's first Master of Philosophy in

BioFabrication, run by the University of Wollongong, with ACES support, in collaboration with Queensland University of Technology, Utrecht University (the Netherlands) and the University of Wurzburg (Germany), trains graduates for a future job that probably doesn't exist yet, in a field that's set to take off. The field of biofabrication is an emerging one in which a connection is made between medicine and technology. Think-prosthetic limbs controlled by thought alone, and bionic implants to restore lost senses, and of course-3D printing of human organs. One possible job description - biomedical engineer - is already taking off in the US. In fact, in 2012, Forbes rated biomedical engineer number one on their list of 15 most valuable college majors, and in the same year, CNN called it the "best job in America".

Recruited to UOW for the masters double degree were three students in July 2015 - these graduated from UOW in July 2016 and have now completed studying their second year overseas at Utrecht and Wurzburg during 2017. A further student has begun the masters double degree in July 2017.

Four students enrolled in this masters degree in July 2016 however they have chosen not to study overseas during their second year. Those four are due to complete in June 2018.

In 2017 ACES UOW has hosted three Wurzburg students and six Utrecht students (due to complete by July 2018) undertaking their second year in the double masters degree. The students have already completed a full semester of equivalent coursework subjects at their home institution.

Graduates of the Biofabrication masters program will have an international network, a track record of collaboration with world leading bionics, fabrication and bioethics experts and an appreciation of all the processes involved in taking an idea through to commercial reality.

BIOFAB MASTERS TO PHD SCHOLARS

UOW Biofabrication Masters graduate Malachy Maher began his PhD, a joint CSIRO and UOW project and scholarship, 'Development and evaluation of new biologically based materials for bioprinting cells' at ACES UOW late December 2017.

UOW Biofabrication Masters graduate Jeremy Dinoro was awarded a PhD scholarship with the ARC Biofabrication Training Hub. He will begin his project '3D printed Porestar' in early 2018 and will be working with Anatomics on this project.

MASTERS DEGREE ELECTROMATERIALS SCIENCE

In 2016 the ACES nodes at the University of Wollongong and Deakin University launched Australia's first joint postgraduate masters degree in



electromaterials science, with emphasis on the use of new fabrication tools to build devices containing next generation materials. The course was designed to ensure that the students gain maximum benefit from the unique multidisciplinary expertise in ACES in a bid to prepare skilled people who can progress the technology. The study of electromaterials has, until now, been confined within subjects like chemistry, electrochemistry or materials engineering. The new masters degree provides the depth of knowledge required to take the technology to the next level.

One student, Matt Russo, was enrolled at Deakin University in 2016, and Karmjeet Buttar commenced at Deakin University mid 2017, with a further student to commence 2018.

ACES PhD students also welcomed the chance to refresh their electromaterials background knowledge by attending the lectures from the course.

MASTERS PROGRAM IN MATERIALS SCIENCE AND CHEMICAL ENGINEERING

ACES, through Deakin University, are now involved in a European Masters course "Materials for Energy

Storage and Conversion" (<https://www.u-picardie.fr/come-to-the-upjv/mundus-mesc/give-energy-to-your-studies--418039.kjsp>).

The European Master Course 'Materials for Energy Storage and Conversion' (MESC) is designed to provide a two year education program in Materials Science and Electrochemistry at 8 universities in 6 countries: France (Marseille, Toulouse, Amiens), Poland (Warsaw), Slovenia (Ljubljana), Spain (Bilbao), US (Philadelphia) and Australia (Geelong). These universities host world renowned, leading research laboratories in the field of energy related materials.

In 2018 ACES at Deakin University will host two students for their research thesis (6 months). ACES Deakin are also part of the application for Erasmus funding to fund this Masters course for future years, which will involve Deakin hosting up to 5 students per year and European Universities hosting up to 5 Australian PhD and Masters.

SUMMER SCHOLARSHIP PROGRAM

The summer scholarship program is designed to encourage undergraduates into ACES post graduate programs. In

2016-17, five undergraduate students worked at ACES (Deakin and UOW) as part of a 10 week summer scholarship. For 2017-18 we have two students enrolled. The students and their projects are:

- Macleay Stephenson (ACES UOW) - Development of Integrated Printer
- Brodie Leeson (ACES UOW) - New 3D Printer Interface
- Jonathan Clark (ACES UOW) - Coaxial Printing Patterned Shell - vary cross-linking
- Chengcheng Wu (ACES Deakin) - Solid electrolytes for Na-air batteries
- Yahui Tang (ACES Deakin) - Carbon materials as catalysts for oxygen reduction reaction
- Benjamin Filippi (ACES UOW) - Computational modelling of coaxial melt electro-writing head.
- Nafis Ahmed (ACES UOW) - Six axis manipulation of biofabrication tools.

STUDENT INTERNSHIPS AND RESEARCHER EXCHANGES HOSTED AT ACES

27 students from international universities have chosen to study with ACES in 2017.

1. Yunfeng Chao, a CSC scholarship recipient, is with ACES at UOW for 3 years working on 'Fabrication of graphene structures for energy storage using roll-to-roll printing'.
2. Zan Lu was at ACES UOW on an 18 month CSC scholarship from January 2016 on 'Mechanical-Electrical Properties of Carbon Nanotube Yarns and Applications in Smart Textiles'.
3. Kezhong Wang, a recipient of a 12 month CSC scholarship, spent 2016 in ACES at UOW working on wet spinning graphene fibers. *In September 2017 Kezhong began his PhD with ACES UOW.
4. Rachel Waldrom, an undergraduate student from Cardiff University in Wales, spent 9 months at ACES UOW, from 1 August 2016, working

-
- on graphene nanocomposites for photo-electrocatalytic water treatment.
5. Yuka Shimazu from ACES partner Yokohama National University worked at ACES UOW between 25 September 2016 and 5 February 2017 on fabrication of a double layered vessel structure.
 6. Sarah-Sophia Carter, Biofabrication Masters student from Utrecht University spent ten months at ACES UOW completing the second year project of the dual degree, from September 2016. Her work involved three dimensional islet cell printing; including a three week stay with ACES collaborators Prof Toby Coates at Adelaide hospital.
 7. Sylvia Van Kogelenberg, Biofabrication Masters student from Utrecht University in Netherlands spent ten months at ACES UOW completing the second year of the dual degree, from September 2016. Silvia's project involved creating a printable polymer suitable for fibroblastic cell growth, and providing an optimal microclimate whilst delivering small molecule modulators to enhance the wound healing process.
 8. Eoin Murray, DCU postgraduate student working with ACES AI Morrin, spent three months at ACES UTAS node working on portable chromatographic systems for nutrient monitoring, Jan-March 2017.
 9. Linda Abbassi, Université de Montpellier, France spent six months, 16 January-28 July, working on her project 'development of novel plastic crystal-based membranes for gas separation' at ACES Deakin University.
 10. Jordan Joel was a visiting undergraduate working with CI Jun Chen at ACES UOW for 9 months from January 2017.
 11. Mr Akihiro Tuchiya, a visiting student from Shinshu University, Ueda Japan, spent two months working with ACES SRF Pawel Wagner at IPRI UOW from 1 March-31 April.
 12. Maxim Brodmerkel, Wurzburg University in Germany, spent ten months at ACES UOW completing the second year of the dual degree, from July 2017.
 13. Juliane Kade, Wurzburg University in Germany, spent ten months at ACES UOW completing the second year of the dual degree, from July 2017.
 14. Marius Berthel, Wurzburg University in Germany, spent ten months at ACES UOW completing the second year of the dual degree, from July 2017.
 15. Mr Valentin Fell, a visiting student from Strathclyde University, Glasgow UK worked with ACES SRF Pawel Wagner at IPRI UOW from 14 August-8 December.
 16. Rhiannon Morris, School of Chemistry, Cardiff, UK, is working with CI in het Panhuis at IPRI UOW, 20 August 2017-1 May 2018.
 17. Itziar Aldalur Ceberio from CIC EnergiGUNE, Spain spent four months, 25 August-3 December, working on the project 'highly conductive Jeffamine® based polymer electrolytes as alternative materials in battery application' at ACES Deakin University.
 18. Bing Lin, Beijing University of Chemical Technology, China is a visiting student at ACES Deakin from 25 September.
 19. Diego Castañeda Garay, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
 20. Stefan Zaharievski, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
 21. Laura Blanco Peña, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
 22. Max Renes, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
 23. Gilles van Tienderen, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
 24. Gregor Weisgrab, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
 25. Xiaomin Zhang from Nanjing University, China is being hosted on a postgraduate research exchange at ACES Monash University from 29 September 2016 through to 3 March 2018.
 26. Fleurine Eberle from Wurzburg University, Germany was hosted at ACES UOW to undertake 6 months of her masters thesis working on metal 3D printing from 1 October 2017 to 31 March 2018.
 27. Subhra Gope, Indian Institute of Science (IISc), Bangalore, India studied at ACES Deakin on Novel Cathode Materials for Li-S batteries from 6-25 November.
- The ACES Research Training Group (RTG) is responsible for designing, establishing and implementing an innovative research training and career development / mentoring program, including various industry and web-based programs. Highlights from the program are outlined below.
- ### WEBINAR
- Being part of ACES - or even introducing yourself to ACES - gives you access to an international research network that has been 30 years in the making, and can add value to your project and in the long-term, your career.
- The ACES network is vast, encompassing eight national and

five international institutions, which between them have the expertise required to incorporate the amazing properties of new materials into devices such as drug eluting implants, biodegradable batteries and fabrics containing sensors.

A partnership with the Australian National Fabrication Facility Materials Node, Wollongong, also provides the 3D printing capabilities to fast-track the development of an idea into a device or solution.

The point is, that researchers no matter where they are from, can access this network. The question for many, particularly those starting out in their career, is how?

To address the question and more, Prof Wallace hosted a webinar called 'Building collaborative research networks' on 11 April.

Attendees learnt:

- How to get the most out of their 'ACES passport' or connection
- What to look for in a collaboration and how to go about setting it up and maintaining it
- What to expect in terms of collaborative success, including case studies.

AND...because we appreciated that networks will be different at various stages throughout a career, attendees also heard from:

- ACES affiliate PhD Candidate and 2016 Bill Wheeler Award recipient, Changchun Yu
- UOW Masters graduate turned additive fabrication technician, Adam Taylor
- ACES Early Career Researcher, Dr Binbin Zhang who completed her PhD with the support of the Hearing CRC and is bound for Japan in 2018 to embark on a prestigious fellowship.

ACES RESEARCH THEME AND TRAINING WORKSHOPS

The ACES workshop program targets the professional development of research staff and postgraduate



ACES CI Prof Robert Kapsa experiencing a simulation of the interior environment of a cell at the ACES-CNBS joint workshop.

students, as well as key areas of continuing technical and scientific education. The workshops were undertaken in the form of:

- ACES Full Centre Meeting (20 July 2017) – included a training session on ACES - Aquahydrex 'Building robust Electrochemical Devices' given by Paul Barrett, CTO & General Manager Aquahydrex.
- Weekly theme meetings (1 March-13 December 2017) between all nodes within the Centre via video link. The ACES all virtual meeting is once per month as are each of the individual virtual theme meetings.
- A number of face to face targeted ACES research theme workshops.

Targeted research theme workshops held in 2017 included: an introduction to 3D printing capabilities at ACES; electrochemistry workshop; MasterClass in advanced electrochemical techniques; GelMA material processing workshop; solar fuels; carbon dioxide reduction; hydrogen experimental design; batteries; designing for robotic hand prototypes; applied 3D fluidics; neural bionics and

synthetic biosystems review and ethical issues associated with 3D bioprinting.

These workshops provide specialist research training for PhD and early career researchers (ECRs), and include mentoring for research planning and positioning for career opportunities (see Appendix 1 for a table listing all these activities).

CENTRE OF EXCELLENCE JOINT WORKSHOP: 3D PRINTING & WOUND HEALING

ACES organised a joint workshop with the ARC Centre of Excellence in Convergent Bio-Nano Science and Technology (CBNS) to identify areas of collaboration and to familiarise centre researchers with the activities happening within the respective centres. The research undertaken by the Centres' ECR and students was the main focus for the workshop. Topics ranged from sensors for tracking the intracellular movement of nanoparticles, the influence of nanomaterial size and shape on bio-nano interactions, optimal and electrical stimulation of cells and controlled drug release.

Table 4: Examples of ACES Travel Activity for 2017

	Total # ACES attendees	ECR	PhD	Affiliate PhD	Masters students	CI /PI/AI	RF Engineers
International Symposia (hosted by ACES)							
ACES Electromaterials Symposium (UOW)	117	16	27	31	-	25	8
BAMN2017 (UOW)	64	3	6	17	13	20	4
ACES Targeted Workshops							
ACES Full Centre Meeting (UOW)	101	13	29	14	2	32	11
Bioethics workshop (UOW)	21	-	6	3	10	3	2
'Modelling, building & interrogating neural network' workshop + associated SBS theme meeting (UOW)	20	1	5	4	3	6	4
Battery Workshop (Deakin)	24	2	10	-	-	3	-
Entrepreneurship certificate (Sydney)	16	2	7	8	2	3	4
EFD theme meeting (UTAS)	16	3	3	1	-	5	-
ACES-YNU workshop (Japan)	16	1	3	1	-	5	-
ACES-CNBS meeting (St V's Melbourne)	20	-	6	1	-	5	4
Cross nodal research visits							
ACES Cross nodal visits (additional to targeted workshop/conference attendances)	35	11	11	1	1		
Other supported travel activities							
Non ACES Conference presentations	107	20	13	20			
Non ACES Collaboration visits	95	10	6	2			

A number of poster presentations were held in the 3DBioFab mixer area for attendees to discuss during tea breaks and lunch. In addition there were a number of opportunities for networking and discussion on ways forward for collaboration – for example in the area of bio-imaging and quantification of bio-nano interaction.

ACES TRAVEL SUPPORT AND CROSS-NODAL EXCHANGES FOR EARLY CAREER RESEARCHERS AND STUDENTS

Students and ECRs are supported to attend and present their work globally at conferences as well as to undertake collaborative visits. The exchange of personnel between nodes is also a vibrant area of activity within ACES.

On average between 15-30 members, many students or ECRs, attended each ACES targeted workshop (29 were held in total in 2017) organised as part of ACES research training activities. Table 4 shows a selection of those workshops with associated attendee breakdown.

Travel between nodes to undertake multidisciplinary research tasks is also encouraged and supported. Support was provided for 38 cross nodal visits during 2017. Please note these visits were additional to the support provided to attend the targeted workshops and/or conferences.

EFFECTIVE TRAINING

The ACES team is committed to research excellence in an environment that ensures effective training for future research leaders or researchers equipped with the skills for next generation manufacturing.

Enabling AquaHydrex: Aquahydrex is a spinout company established from ACES hydrogen-production technology to produce clean energy solutions. Ten ACES graduates (2005-2013) form its technical backbone.

Hubs: ACES CIs are leading research projects in 2 research hubs (Steel and Fibre), 2 training hubs (Biofabrication, Portable Analytical Separation Techniques) and the BatRIhub.

Bioengineering facility BioFab3D@

ACMD: St Vincent's Hospital, Melbourne and partners, University of Melbourne, University of Wollongong, RMIT University and Swinburne University of Technology, are at the forefront of the 3D bioprinting revolution. Together they have established the BioFab3D@ACMD in 2016, Australia's first robotics and biomedical engineering centre embedded within a hospital. Former ACES PhD graduate and ECR Cathal O'Connell is the BioFab3D@ACMD Centre manager.

ACES is a national institution with international connections and as such, it provides a unique training environment that opens up global opportunities for our graduates.

Prestigious fellowships:

- In 2017, ACES ECR Binbin Zhang was awarded a prestigious fellowship to work with ACES international collaborator Prof Junji Fukuda at Yokohama National University in Japan. Binbin's expertise in 3D bioprinting will help Prof Fukuda develop a novel approach to build more complex organ tissues.
- In 2017, ACES ECR Rouhollah Jalili and AI ECR Dorna Esrafilzadeh were awarded Vice-Chancellor's Postdoctoral Fellowships at RMIT where Rouhollah will be aligned with the program 'Advanced Manufacturing and Fabrication' and Dorna with 'Biomedical and Health Innovation'.

ACES CAREER DEVELOPMENT IN ACTION

ACES STUDENT SPOTLIGHT

When US born ACES masters' student Charles Hamilton accepted an ACES

scholarship to study at the University of Wollongong's Innovation Campus he had no idea it would lead him back to the US for a stint at Harvard University. Charles tells us about his experience.

Where did you grow up?

I grew up in the suburbs of Middletown, New Jersey on the east coast of the United States.

What did you study as an undergraduate?

I completed my undergraduate education at Colgate University in Hamilton, New York in 2015 where I graduated with honours in physics and a minor in chemistry.

What did you study as part of your ACES scholarship?

The ACES scholarship at the University of Wollongong was to work on 3D printing tough actuating hydrogel materials for the soft robotics team

Why did you go to Harvard University?

I was a visitor of The Vlassak Group (Prof Joost Vlassak and Prof Zhigang Suo (who also has his own group) from November 2016 to February 2017. I was based at the School of Engineering and Applied Sciences at Harvard.

The ACES group has collaborated with the Vlassak Group in the past through a previous PhD student, Shannon Bakarich, who worked on 3D printing ionically conductive hydrogels. Great progress was made, with identical 3D printer setups now at Harvard as well as Wollongong – making it easy to work on aspects of a project simultaneously. The aim was to continue the collaboration by identifying some areas/applications that could be useful and my work was chosen.

What did you work on during your stay?

I worked on using capacitive coupling of a 3D printable hydrogel-elastomer device to detect electrical signals.

Basically a proof of concept project towards a soft 3D printable cuff electrode for peripheral nerve signal sensing. This research fits into the control aspect for the ACES soft robotic prosthetic hand.

Following the visit the next step is to scale the size of the cuff down and test the limits of the device. Can it be used to detect signals on the sciatic nerve of an animal?

While at Harvard I was also given the opportunity to present a poster of my research at the 2017 MRS Symposium.

What did you learn from the experience?

Profs Vlassak and Suo were extremely knowledgeable. I learned a lot about passing electrical signals through ionically conductive hydrogels and understanding some key concepts on a more fundamental level. I spend most of my time at ACES UOW working with hydrogels and liquid metal alloys so it was nice to work with some elastomeric materials at Harvard.

I also learned a lot about how different institutions run their research labs and how things can be structured.

What is next?

I completed my ACES Masters degree at UOW and I have chosen to study medicine at the Robert Wood Johnson Medical School in New Jersey, USA.

ACES EARLY CAREER RESEARCHER SPOTLIGHT

ACES Early Career Researcher Dr Binbin Zhang has been awarded a prestigious Fellowship with the Japan Society for the Promotion of Science.

The Fellowship, starting in November 2017, will enable Dr Zhang to work in Japan for two years with ACES AI Prof Junji Fukuda at Yokohama National University.

Dr Zhang will take her expertise in 3D printing to Prof Fukuda's lab, which has developed a new way to engineer vascular tissue constructs – a critical



factor in fabrication of large tissue constructs including human organs.

Dr Zhang said the Fellowship will allow her to further develop her experience and skills in tissue engineering.

"I'm very excited about this opportunity, not only do I get to work within a world leading research group in the area I'm very passionate about, I will also expand my international networks and form long term collaborations," Dr Zhang said.

"I'm also hoping to publish high impact journal articles and attend international conferences during my fellowship. All these things will help me build a good career track record and hopefully make me more competitive in future grant applications."

Dr Zhang got to know Prof Fukuda through her work with ACES, at which she also completed her PhD on a project funded by the HEARing CRC and now works as Research Fellow in the field of 3D BioPrinting.

"The workshops and training programs provided by ACES have helped me with my skills in writing applications, especially those like this Fellowship application that require not only details

of the research, but the impact to society."

GRADUATE SPOTLIGHT

ACES AFFILIATE STUDENT LEO STEVENS

Leo Stevens finished his PhD as an affiliate with ACES lead node, the Intelligent Polymer Research Institute at the University of Wollongong in 2016.

He's currently working across several jobs and projects including continuing his material science research, lecturing at the University of Wollongong and sitting on the advisory board of a start up company.

Research

During his PhD Leo worked as part of a team that was trying to improve regeneration in injured nerves. His contribution to that effort involved designing and testing new materials that would support nerve cells and direct their regeneration through a channel known as a 'nerve guide'. It was an exciting project with a great real world application, and I'm happy to have chipped in.



Experience at ACES UOW

My favourite experience from ACES would have to be the conferences, and in particular, one I attended in Boston at the end of 2015. Conferences provide a fantastic opportunity to meet fellow researchers, learn interesting things, and see a new part of the world, not to mention stretching your legs away from the confines of the office or the lab. I suspect most PhD students would give a similar answer, attending conferences is undoubtedly one of the perks of a research career.

ACES is underpinned by a long term grant from the Australian Research Council that provides a level of certainty and continuity that is rare in the modern academic world. This funding has not only allowed IPRI to build great facilities

and hire great researchers, but it has also attracted a large network of collaborators from Australia and across the world. It is rare for a PhD student to be able to tap into such a rich pool of knowledge and equipment, and that absolutely opens doors in terms of both research and professional development. Hopefully the next crop of PhD students is driven enough to take up those opportunities to expand their horizons, and perhaps ours as well.

The Future

In the university sector you often hear the comment that great research is being done, but there is not enough training or incentive to support researchers to transition their work into real world products. I've been doing my best to build business skills

alongside my academic training, so I will be able to make myself useful in bridging that gap between research and reality. Ultimately, I'd love to run a commercial R&D hub or start-up incubator, helping to invent new technologies and then taking those products to market.

Leo graduated in 2017. His supervisors were ACES CIs Gordon Wallace, Marc in het Panhuis and ACES research fellow Dr Kerry Gilmore.

ACES AFFILIATE STUDENT SHANNON BONKE

The award of Doctor of Philosophy was conferred upon ACES affiliate student Shannon A Bonke for the thesis "Towards Light Driven Water Splitting" in January 2017. International thesis assessment from

a leader in the field awarded perfect marks. Dr Bonke has been an affiliate of the Monash ACES group since 2012, first completing an Honours Degree of Bachelor of Science with a mark of first class and now a Doctor of Philosophy.

On 6 January 2017 Shannon joined Helmholtz Zentrum Berlin für Materialien und Energie as a postdoctoral research fellow within the Institut Nanospektroskopie in Berlin, Germany. Research combining electrocatalysis and electron paramagnetic resonance will be undertaken with ACES AIs Dr Alexander Schnegg and Prof Klaus Lips in the Berlin Joint EPR Lab and the BESSY-II synchrotron facility.

CHIEF INVESTIGATOR SPOTLIGHT

Prof Simon Moulton has been involved with ACES since the very beginning, first as a post doc and more recently in the current centre, as a Chief Investigator.

In late 2014, Simon moved from Wollongong to Melbourne, where he took up a position at Swinburne University of Technology.

Swinburne officially became an ACES node in late 2016, with their research strengthening the Electrofluidics and Diagnostics, Synthetic BioSystems and Electromaterials themes.

Simon now leads an ACES team of two Associate Investigators (biomaterials expert Sally McArthur and optic physicist Paul Stoddart), as well as three PhD candidates – Daniela, Lilith and Shaun.

Daniela is working on developing an electro-optic material suitable for cellular stimulation, while Shaun and Lilith are concentrating on drug delivery systems including optical stimulation and micro carriers in 3D structures.

In 2017 Simon was appointed BioEngineering Program Leader for the Iverson Health Innovation Research Institute.

TRAINING OPPORTUNITIES

CONTINUING PROFESSIONAL DEVELOPMENT (CPD)

ACES members are encouraged to participate in continuing professional development activities run by their host universities and others complete CPD activities run by external companies.

RESEARCH INTEGRITY ADVISOR ROLE FOR ACES CI

CI Mozer has taken up the role as Research Integrity Advisor for the AIIM facility at UOW. In this role he attended the ANDS-ARMS RIA Data Management workshop hosted by UNSW Sydney, 7 August 2017. The purpose of the workshop was to raise awareness of the importance of Research Data Management (RDM), provide best practice and practical guidance, and to enhance Research Integrity Advisors' capacities to provide RDM advice to researchers across Australia.

The workshop covered four key areas:

(i) Principles and responsibilities in research integrity and research data management; (ii) Perspectives on data management and future direction; (iii) Research data management in practice and (iv) Data management from researchers' point of view.

IDENTIFYING ENTREPRENEURS NEEDS

Natalie Ralph, ACES RF Deakin, participated in Melbourne Energy Institute & Powershop's 'Energy Hack Weekend' held at the University of Melbourne, 20-22 October 2017. She worked in a small team developing a renewable energy technology/business concept, applying an ethical/social issues approach to the concept. This identifies entrepreneurs' needs in terms of ethical/social knowledge in energy.

ACES UOW CI A/Prof Jeremy Crook undertook at Ignition IP Workshop - Medical Device Commercialisation Training Program run by Cicada Innovations Programs, Wollongong, Australia.

Other activities towards CPD included:

- ACES Director and COO attended the annual ARC Directors and COO Forum in Canberra 26-27 April. COO facilitated a round table discussion session on outreach/media.
- ACES RF UNSW Eliza Goddard attended a research training workshop on Consumer Engagement in Research hosted by the Consumer and Community Health Research Network, 5 October 2017
- ACES RF Carmine Onofrillo attended the workshop 'Nail the Grant 2017', hosted by Royal Melbourne Hospital, Fitzroy North, Melbourne.
- ACES AI Luke O'Dell attended Mental Health First Aid training at Deakin University, November 2017

MENTORING ACTIVITIES FOR AND BY ACES MEMBERS

ACES CI Marc in het Panhuis was a mentor for the UOW Early Career and Mid Career Researcher Development Program. In 2017 he was mentor to 1 x level B, 1 x level C and 1 x level D staff members.

ACES CI Coote was an invited panelist at the Network of Women Students Australia (NOWSA) workshop, held at parliament house, Canberra 18 July. The panel were discussing 'Women in Male Dominated Fields'. The audience was a mix of undergraduate and postgraduate students.

The American Chemical Society (ACS) ran a day of presentations and panel discussions about publishing, communication skills, reviewing skills and careers (UNSW July 18 and Melbourne July 20) and JACS editor and ACES CI, Prof Michelle Coote, presented to audiences of students, post doctoral researchers and academic staff at each event.

CI Coote was University of Tasmania's inaugural 'women in STEM lecturer' and in September an invited panel member for a discussion on women in STEM – challenges and solutions.

ACES CI Hancock and Dr Vince Marotta (Deakin Sociology) organised two workshops in 2017. The first, 30 August, was on 'submitting and editing a special issue proposal'. During this workshop attendees were mentored on how to publish a special issue edition. The organisers highlighted examples from: Journal of Environmental Accounting and Management & Journal of Cleaner Production & Australian Journal of Political Science and looked at:

- what editors look for in special issue proposals, how to structure a proposal and what happens after it has been accepted.
- examples of successful and unsuccessful proposals highlighting some of the pitfalls that scholars should avoid.

In the second workshop 'Meet the publisher- an ECR workshop' attendees (2 ACES ECR, 15 ECRs Deakin University) were given the opportunity to hear from representatives from a leading social science publisher Taylor and Francis, specifically Lucinda Knight (Editor | Education and the Behavioral Sciences) and Eloise Moirford. They discussed: (i) the state of the publishing industry and where it is heading; (ii) the role of open access journals, e-books, and niche publishing and (iii) how ECRs and HDRs can take advantage of social media to promote their work and establish academic networks.

CI Hancock was also a presenter in the workshop 'Excellence in International Academic Publishing' organised by Centre for Responsible Business (CRB) India, 13 November. The workshop was designed and developed by CRB in partnership with Alliance Manchester Business School, The University of Manchester, Aston Business School, Aston University, University of Basel, Deakin University, Schulich School of Business and York University.

Attendees (1 ACES RF, 40 academics, 2 industry, 2 government) were offered a day full of learning, skill building and networking for social science and

business and management research scholars in India.

The workshop was in two parts: (i) an introductory course on theorising to model building; and (ii) learning from the editors of international journals on publishing in international journals.

ACES MENTORING

As a result of the multidisciplinary nature of the research carried out at ACES, the leadership team has taken a non-traditional approach to supervision and mentoring; encouraging researchers to work together in teams, and across traditional boundaries, with access to collaborators' laboratories across the globe. This extends to implementing innovative programs to facilitate researchers in acquiring skills in technology transfer and the commercial development of research. Beyond dedicated mentoring workshops or webinars, ACES exemplifies a culture of innovation, translation and just having a go. Specifically:

ACES appoints junior CIs and ECRs to the ACES Executive Committee for 12 months; ECR Binbin Zhang and CI Jeremy Crook (2015-16), and ECR Justin Bourke, RF Natalie Ralph and CI Marc in het Panhuis (2016-17) have been appointed.

ACES has nominated deputy leaders for ACES research themes, many of whom have now transitioned to take up the reigns of driving the majority of the research activities.

- RF Crisitina Pozo-Gonzales, CI A/Prof Patrick Howlett and SRF Caiyun Wang co-ordinate the SES theme meetings, research group discussions and specialised workshops.
- Prof Robert Kapsa and A/Prof Jeremy Crook drive the SBS research activities.
- A/Prof Jennifer Pringle assists in the co-ordination of the EM theme activities.

Mentored by CI Prof Maria Forsyth, CI

A/Prof Jennifer Pringle has now taken over the role of Chair of the Research Training Group (RTG). CIs Pringle, Innis and Mozer have designed, co-ordinated and run the Electromaterials Masters program.

Dr Alexandr Simonov, mentored by the late Prof Leone Spiccia in the role of deputy group leader of the 'solar fuels' group at Monash University, has capably managed the group since 2016.

Junior CIs and research fellows make up at least half the membership of ACES international conference organising committees.

OTHER MENTORING ACTIVITIES

ACES CI Prof Susan Dodds, theme leader of the ACES ethics, public and policy engagement program was invited to discuss her experiences about being embedded in ACES amongst a lot of STEM researchers to members of the Australian Academy of Social Sciences and the Academy of the Humanities in Australia. The event was held at the ARC offices in Canberra on 10 December and was attended by more than 150 humanities and social science researchers and research administrators.

ACES Executive Director Maria Forsyth hosted a variety of young delegates and Nobel Laureates in Europe for the Lindau Nobel Laureate meeting.

ACES MEMBERS TRAINING OTHERS

LABORATORY BIOTECHNIQUES COURSE

The ACES members at St Vincent's Hospital Bionics laboratory conducted a training course for 16 second year Medical Students from Universitas Indonesia, Indonesia as part of their Advanced Medical Science (AMS) year from 16-27 October 2017. The 'Laboratory Techniques' course introduced the students to the theory and practice of conducting medical research.

ACES INVITED TO DELIVER LECTURES AT HANBAT UNIVERSITY IN KOREA

ACES CIs A/Prof Attila Mozer (7 -14 November) and A/Prof Michael Higgins (9 -15 December), gave a series of lectures to post graduate students at Hanbat University, Daejeon in South Korea.

Lectures included fundamentals of solar energy conversion and solar cells and solar fuels; porphyrin-sensitised solar cells and Atomic Force Microscopy (AFM) - fundamental surfaces forces, biological interactions and forces and an overview on the use of Bio-AFM to

study protein/cell interactions with electromaterials.

Two excellent ACES PhD applicants have been recruited to ACES from previous year's trips.

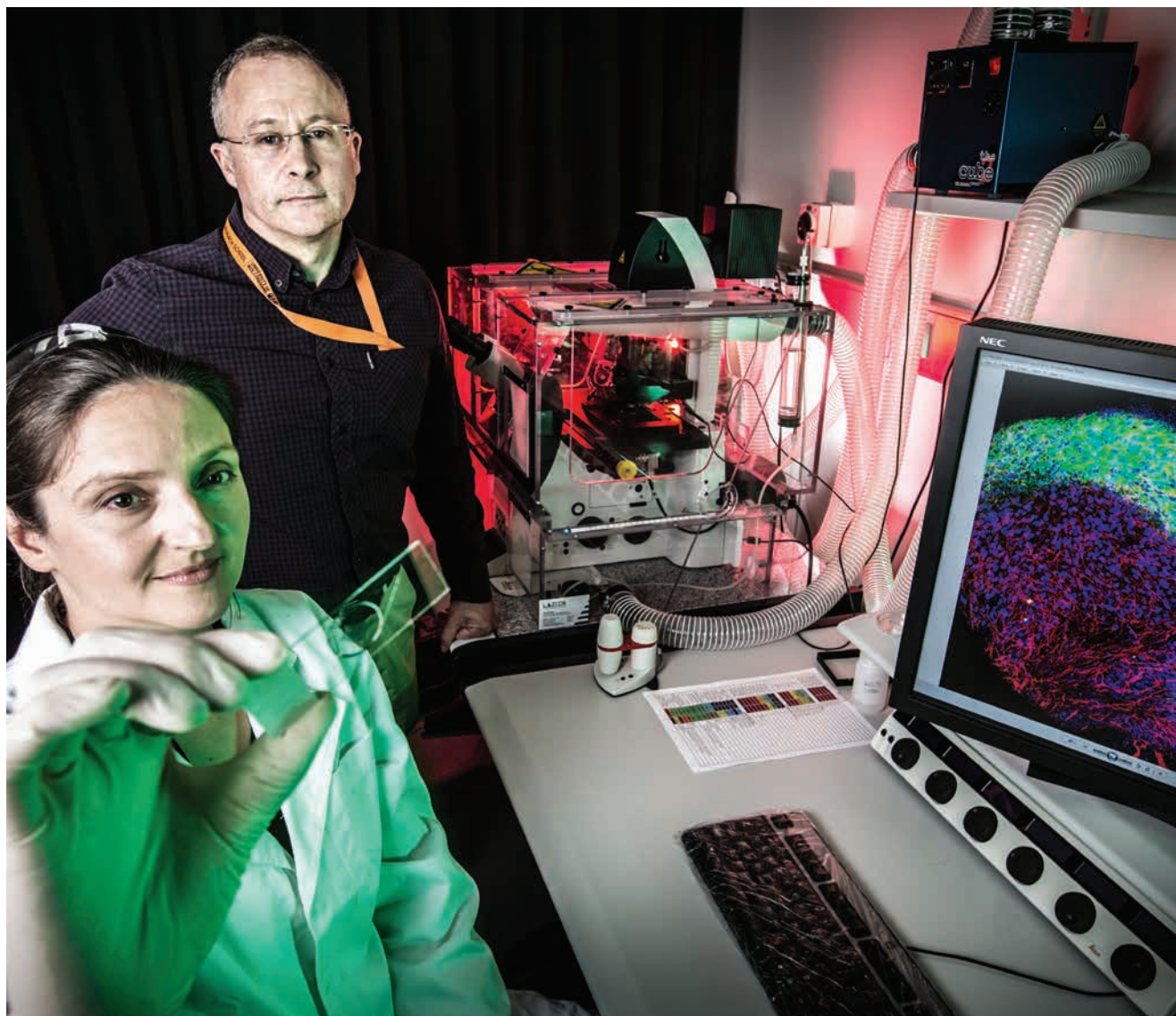
WORKSHOP 'HOW CAN BUSINESSPEOPLE HELP PREVENT VIOLENT EXTREMISM?'

Natalie Ralph, RF ACES Deakin, presented a 90 minute workshop on 'How Can Businesspeople Help Prevent Violent Extremism?' which included case studies/scenarios of alternative energy businesses and projects impacting on tensions and extremism. This was

part of a two week course entitled, Understanding Contemporary Terrorism and Developing Policy Responses, 2017, for Indonesian practitioners held in Canberra 18-29 September.

INVITED WORKSHOP '3D PRINTED MICROFLUIDIC CHIPS'

ACES RF Niall P. Macdonald and ACES AI Michael C. Breadmore (UTAS) along with Rosanne Guijt (Deakin University) and Gregory Nordin (Brigham University, USA) gave a workshop on '3D printed microfluidic chips' on 22 October 2017 as part of MicroTAS2017 in Savannah USA.



Knowledge Translation

ACES STRATEGIC PLAN GOAL 3: TRANSLATION COMMERCIALISATION

Our goals are to:

- To implement strategies for effective industry engagement and knowledge transfer to industry partners.
- To utilise appropriate business tools to identify and select commercial opportunities in the early stages of ACES.
- To implement effective knowledge transfer strategies that facilitate the development of new business opportunities.

Our target audience is primarily investors. ACES can facilitate the development of technologies to create new disruptive business opportunities and to augment existing businesses.

TOWARDS OUR GOALS

The research landscape is changing and is expected to continue to change in such a highly competitive field. No longer is research success measured only by the number of papers and citations, instead researchers value translation of the accrued knowledge into solutions for challenges encountered by the communities we work for.

As ACES creates new knowledge it is channelled into existing commercialisation networks (through Cooperative Research Centres (CRCs)); helps build new activities with existing companies (through ARC Linkage Hubs, other grant proposals and direct funding of commercial projects) and in collaborations with other end-users,

such as clinicians (through NHMRC grants and Garnett Passe funding).

ACES has been an integral component in the building of new facilities such as the BatTRI Hub at Deakin and the 3DBiofab facility at St Vincent's Hospital in Melbourne, with a view to attracting further end-user engagement.

We have embarked on the journey to identify ACES activities that could result in new commercial ventures, through investment and partnerships. Local industry can also realise global opportunities by tapping into internationally recognised and networked research organisations. We at ACES are keen to take world class science and turn that into next generation manufacturing in partnership with local industries.

Our innovative training programs are preparing next generation researchers to ensure effective knowledge dissemination.

ACES - AUSTRALIAN NATIONAL FABRICATION FACILITY (ANFF) PARTNERSHIP

ACES is funded to translate materials science knowledge into practical, game-changing devices that will have a significant impact in the areas of diagnostics, energy, health and soft robotics.

Rapid advances have been made possible through the integration of fundamental materials science research with cutting edge approaches to fabrication, including 3D printing. Our continued partnership with ANFF is critical to translating our research into real world devices.

The ANFF Materials Node is headquartered alongside ACES at the UOW Innovation campus. ANFF

provides ACES researchers, external collaborators, publicly funded researchers and end users with access to fabrication capabilities and materials synthesis through state-of-the-art facilities for the production of small- to large-scale quantities of nanostructured materials (e.g. electronic polymers, conducting carbons, graphene and macromolecules) coupled with additive manufacturing facilities and expertise.

Our current activities towards translation of ACES fundamental research are summarised below.

COOPERATIVE RESEARCH CENTRES

CELL THERAPY MANUFACTURING (CTM) COOPERATIVE RESEARCH CENTRE (CRC)

This ACES collaborative effort was established in 2015 with the University of Adelaide and the CTM CRC for printing cells in scaffolds in partnership with clinical collaborator Prof Toby Coates.

CRC FOR POLYMERS

ACES involvement in the CRC for Polymers has resulted in new solar cell technologies. The CRC for Polymers officially finished in June 2017 however ongoing work on the technology developed will continue until early 2018. Further commercial support is currently being sort for this research.

ENERGY PIPELINES CRC

ACES involvement in the Energy Pipelines CRC assesses materials, coating selection, application and testing.

HEARING CRC

ACES involvement with HEARIng CRC has produced new electrode and controlled delivery technologies

Professor Gordon Wallace, an Australian Laureate Fellow and Director of the ARC Centre of Excellence for Electromaterials Science at the University of Wollongong, received the CSIRO Eureka Prize for Leadership in Innovation and Science.

POWERFUL RESEARCH-INDUSTRY PARTNERSHIP

The ARC Centre of Excellence for Electromaterials Science (ACES), led by ARC Australian Laureate Fellow, Professor Gordon Wallace—and the Australian National Fabrication Facility (ANFF) have forged a powerful partnership that is catapulting fundamental research into practical and useful structures and devices.

ACES, administered by the University of Wollongong, undertakes fundamental research to understand material cellular interactions and discover how these interactions can influence biological processes.

ANFF—established under the National Collaborative Research Infrastructure Strategy—links eight university-based nodes to provide researchers and industry with access to state-of-the-art fabrication facilities.

Their partnership is bringing together scientists, engineers and clinicians to undertake interdisciplinary research that is enabling existing industries to explore new opportunities and is creating new manufacturing industries. Recent research outcomes include:

- Cartilage Regeneration: printing of cartilage regeneration biomaterials that can be implanted into patients suffering from conditions like arthritis
- Islet Cell Transplantation: the development of an ink containing biomaterials that protect islet cells during the 3D printing process to help treat type 1 diabetes
- AquaHydrex: new materials that facilitate the breakdown of water into important fuels—hydrogen and oxygen.

By coupling world-class research expertise with quality facilities and equipment, the ACES-ANFF partnership has positioned itself as an outstanding commercial researcher partner. For example, Aquahydrex Pty Ltd, a start-up company based on fundamental research from ACES, extensively utilised the fabrication capabilities of ANFF.

The ACES team expects other new commercial opportunities in 3D bioprinting to emerge in the near future.

relevant to the Cochlear implant, in partnership with clinical collaborator Prof Stephen O'Leary.

AUSTRALIAN RESEARCH COUNCIL (ARC) LINKAGE HUBS

ARC RESEARCH HUB FOR A WORLD CLASS FUTURE FIBRE INDUSTRY

ACES involvement in the ARC Research Hub for a World Class Future Fibre Industry at Deakin University is seeing the translation of fundamental findings into developing novel fibre technologies to facilitate more sustainable, advanced manufacturing of fibre materials and products.

ARC STEEL RESEARCH HUB

ACES involvement in the Steel Research Hub at the University of Wollongong is seeing the translation of fundamental findings into antimicrobial coatings.

ARC TRAINING HUB FOR BIOFABRICATION

ACES, through the University of Wollongong, is partner in the ARC Training Centre in Additive Biomanufacturing. The research is structured around three synergistic and innovative programs – Technology, Materials and Clinical Translation. Industry partners include Osteopore, Anatomics and Cochlear. Surgeons from St Vincents Hospital Melbourne and the Peter MacCallum Cancer Centre will drive the introduction of additive biomanufacturing into clinical applications.

NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL (NHMRC)

ACES materials continued to be developed and used in an NHMRC project in 2017. This assists the translation of the research by taking the *in vitro* materials work and testing those materials as well as developing techniques *in vivo*. Grant 1062569 uses ACES materials in the development of a biopolymer conduit for peripheral nerve repair.

OTHER GRANTS

2017-2020: CI Howlett, CI Wang, AI Greene were awarded a United States Army Research Office grant (\$344,429) for "Design of high ion conductivity in polymer/OIPC composite through understanding the effect of chemistry on structure and ion dynamics at polymer/OIPC interfaces"

2018 Arthritis Australia Project grant (\$30,000) was awarded to the Biopen team for '3D printing of bio-adhesive scaffold for cartilage regeneration.'

US Army Research Laboratories:

ACES CI Marc in het Panhuis is collaborating with US Army Research Laboratories (Aberdeen, USA, <https://www.arl.army.mil>) agreeing, after a visit to the US in August 2017, to extend their current collaboration, mainly on hydrogels, into performance aspects of surfing related research involving the assessment of surfers.

NEW VENTURES

CTECHBA OPPORTUNITY REPORT

A feature of our Centre of Excellence proposal was our commitment to identify new commercial opportunities. ACES carried out a two stage technology audit with CtechBA that was completed in 2016.

In stage 1 CTechBA considered all planned research under the 2014-2017 program and identified a number of commercially significant projects (opportunities) and made recommendations on how ACES can more effectively facilitate technology transfer through those opportunities. CtechBA also absorbed lessons from the experiences of executives of spinout companies that are currently commercialising the IP that was developed under the 2005-2013 ACES program.

The initial project list identified 19 Commercial Opportunities by loosely grouping activities undertaken by each ACES supported research project. Of the 19 Opportunities, 16 were

considered applied R&D. After further internal deliberations the following three areas were identified as areas presenting the most immediate commercial engagement opportunities for ACES.

Progress on these opportunities are as follows:

Thermocells: Two patents were filed in 2015 'Thermo-Electrochemical Cell and Method of Use (PCT/AU2015/901513) and Functionalised Photo-Electrocatalyst and Method for Chemical Conversion (PCT/AU2015/000248)'.

In 2017, a \$15,000 Institute of Frontier Materials Impact Grant was awarded to ACES RF Dr Madeleine Dupont, CI Jennifer Pringle and AI Robert Kerr to develop 'pouch cell' thermocell prototype devices using BatRiHub capabilities and UOW printing expertise.

A proposal was also submitted via NineSigma who were representing clients looking for "Low Grade Heat Recovery Technologies" but the client went for technology that was more advanced.

Tough Hydrogels for a wide variety of applications ranging from 3D scaffolds to condoms. Activity to date in this area is ongoing and has attracted Gates Foundation Funding for Geldom Project Materials and Cook Medical funding for coatings on stents.

Compounds and Structures of Biotechnology (3D bioprinting, hardware and bioinks): Patent "Apparatus and method for handheld free-form Biofabrication" (PCT/AU2016/050886) was lodged; an internal technical liaison group established; SMR have been engaged to establish a manufacturing process and a commercial engagement plan is under development in consultation with Dr Russell Jones (IAC Member).

Lincoln Consulting Group met with key researchers (18 September & 21 November 2017) and collaborating personnel to review the technology surrounding 'Compounds and

Structures of Biotechnology (3D bioprinting, hardware and bioinks)'.

Engagement plans around a number of specific opportunities are being developed:

- Biopen for cartilage regeneration
- iFixpen
- 3D printed ears/noses

Affiliate student Olumayowa Adesanya joined the EPPE program in 2017 to identify general ethical issues relating to bioprinting as a technology; to ascertain the extent to which ethical issues relating to bioprinting may affect patenting bioprinting-related inventions in Australia, Europe and the United States; to examine whether indeed ethics ought to affect the grant of patents and to examine the impact of patenting bioprinting-related inventions on access to medical technologies and identify measures that can be taken to mitigate any negative impact.

BIOPRINTING FACILITY ANOTHER STEP CLOSER FOR UNIVERSITY OF WOLLONGONG

LIEF funding

The University of Wollongong (UOW) is another step closer to establishing a world first facility to enable development of bioinks and customised bioprinting systems for clinical applications, after receiving \$347,000 from the Australian Research Council (ARC).

The ARC Linkage Infrastructure, Equipment and Facilities (LIEF) funding was awarded to UOW and research partners from Deakin University, University of Melbourne, University of Adelaide, Sydney University, St Vincent's Hospital Melbourne, Royal Adelaide Hospital, South Australian Health, South Eastern Sydney Local Health District, the Lions NSW Eye Bank.

The bioprint facility project is being led by ACES/ANFF partnership, both headquartered at UOW. The funding will enable acquisition of state-of-the art 3D printing tools.

These tools will be used in association with our partners to develop customised 3D bioprinting systems for specific applications. The project will address the current and future need for delivering 3D printing globally for research, applied science, medical devices and diagnostics and advanced therapeutics.

Building upon earlier and these current research activities in 3D bioprinting at UOW, we will be in a position to provide a portal to global research and development activities in this area, as well as immediate commercialisation opportunities.

MTP connect funding

An \$800,000 grant, from the Medical Technologies and Pharmaceuticals Industry Growth Centre (MTPConnect) and matching funds, was awarded to ACES at UOW to facilitate the establishment of a bioprint facility.

The aim of the proposed facility is to expediate the development of commercial opportunities in 3D bioprinting and identify opportunities with clinical partners, small medium enterprise (SME) partners and other industries to enable production of relevant biomaterials, formulations of bioinks and customised bioprinting systems.

A prospectus for a 3D printing facility proximal to the University in Wollongong was developed with input from members of the ACES IAC. The facility is anticipated to be launched in 2019.

The MTP funding will be used specifically to engage with SME's to develop projects such as 'bioinks' from seaweed extracts, customised delivery systems - the 'iFixPen' - to treat conditions of the eye and the 'biopen' for cartilage regeneration.

Subsequent to the CTechBA findings other developments have arisen.

Carbon Dioxide reduction: Discussions with True North Venture Partners (TNVP) revealed that CO₂ reduction to useful

products (e.g. ethanol) will provide commercial opportunity. A provisional patent (2016903555) "Nanostructured electrode for CO₂ reduction" has been lodged.

Nitrogen reduction: Discussions with Renewable Hydrogen P/L, Siemens and Yara International revealed commercial opportunity in the reduction of N₂ to NH₃. A suite of patents were lodged by Monash University, including two provisionals (2016900354 and 2016900613) and a PCT/AU2017/000036 "Method and Cell for Conversion of Dinitrogen into Ammonia" was filed 3 February 2017.

Soft Robotics: A 3D printed hand integrated design workshop was undertaken at Deakin University Warun Ponds led by Prof Paul Collins 9-10 October. There were four groups that each took on a particular hand movement profile for which they designed for a particular persona. Design appearance was also discussed.

Moving forward there are now some clear avenues for further development of the soft robotic hand. A commercial engagement plan will be developed during 2018.

BUILDING END-USER NETWORKS

Indicators of the social impact of ACES can be measured through public outreach programs, contribution to policy development and influence on the national research strategy. Our ACES ethics, public policy and engagement team as well as ACES researchers throughout 2017 engaged and interacted with various stakeholders.

'A VOICE' AMONGST INDUSTRY PROFESSIONALS

During 2017 ACES has been given a voice on panels and at symposiums discussing new technologies on the horizon and how they may impact future directions. Through this avenue ACES has been given the opportunity to share our extensive knowledge and engage

in networking that is vital to further translation activities.

IN THE 'BIO' SPACE

CI Susan Dodds is a Member, Australian Health Ethics Committee (AHEC), Genetics and Genomics Working Committee (NS Chapter 3.5), 2013 to current.

ACES Director Gordon Wallace was an invited panel member for the discussion 'Is the current Australian custom-made medical devices regulatory pathway commensurate with the level of risk of 3D printed implantable medical devices?' at the Therapeutic Goods Association (TGA) workshop 'Regulatory considerations for additive manufacturing (3D printing) of medical devices' held 10 August.

Gordon was an invited panel member, alongside The Honorable Brad Hazzard, Minister for Health and Minister for Medical Research, and others at the Royal Australian College of Surgeons RACS NSW Surgeons month 2017, held in Sydney 24 October, for a workshop on 'Barriers to Surgical Innovation'. <https://www.youtube.com/watch?v=YiLSmyTf3cs&feature=youtu.be>

At the 2017 Sydney Cardiovascular Symposium – 'Big Data and the Future of Cardiology', held 8 December, they explored the impact of big data across a gamut of cardiovascular biomedicine, from bench to bedside and back again. ACES Director Wallace was invited to talk on 'Printing 3D structures containing living cells'.

CI Susan Dodds is recognised internationally for her contributions to government and health service understanding of the ethical impact of emerging technologies. In October 2017 she was invited by the World Health Organisation (WHO) to give a presentation on the ethical challenges for national research ethics bodies arising from 3D bioprinting and neural implants at the Asia-Pacific Regional Meeting for National Ethics/Bioethics Committees in collaboration with the United National Educational, Scientific

and Cultural Organisation (UNESCO) Seoul, Korea, 24-25 October 2017.

ACES AI Gilbert, CI Cook and collaborators T O'Brien and J Illes were invited to present 'Embodiment and Estrangement: results from the First-in-Human BCI Trial' at the International Neuroethics Society, Washington, DC, 9-10 November.

ACES AI Gilbert was solicited by Medtronic, with respect to FDA compliances and to provide further information about data published in Gilbert (2017) Deep Brain Stimulation: Inducing Self-Estrangement, Neuroethics.

ACES RFs Goddard and Walker, in collaboration with CI Alici (UOW), Als Choong and Oetemo (UOM) and affiliate PhD Stephens-Fripp (UOW), designed and administered a community survey on 'What users want from a prosthetic hand' https://monash.az1.qualtrics.com/jfe/form/SV_9N4AizMT0ri8MEB.

ACES RF Hutchison, now an ACES AI, gave an invited talk on "Ethical Issues in Maintaining Neural Implants" at the National Institutes of Health Workshop: Ethical Issues in Research with Invasive and Non-Invasive Neural Devices in Humans, Bethesda, MD, USA.

IN THE ENERGY SPACE

CI Hancock gave a special address in the inaugural plenary session 'Understanding the Tragedies of the Commons and implications for Sustainable Development in India' at the India & Sustainability Standards 2017: International Dialogues & Conference 2017 on 15 November. The event offered an occasion for dialogue on challenges and opportunities presented by international and Indian Sustainability Standards and Collaborative Sustainability Initiatives, in supporting business and policy contributions towards positive social, economic and environmental impacts in India and beyond. More information at <http://www.sustainabilitystandards.in>.

ACES RF Ralph met with Greg Hannan, Ausnet Services (gas business) and

former advisor to Victorian Premier, to discuss gas/electricity sector's needs and future and the Liberal party perception on manufacturing of alternative energy technologies, 18 October.

ACES RF Ralph participated in the Melbourne Energy Institute and Powershop's 'Energy Hack Weekend' at the University of Melbourne, 20-22 October, working in a team to develop a renewable energy technology/business concept, and apply an ethical/social issues approach to the concept. This identifies entrepreneurs' needs in terms of ethical/social knowledge in energy.

CI Hancock was elected as a team member of newly established Deakin University Science and Society Network, a cross-University team promoting Science and Technology Studies and knowledge, through innovative research addressing national and global issues, and industry engagement. In February 2017, the team was successful being awarded competitive funding from the Deakin University Cross Collaboration Fund scheme to hold workshops in February, March and May.

ACES EPPE members CI Hancock and RF Ralph along with Rijit Sengupta, CEO Centre for Responsible Business in New Delhi, co-ordinated the meeting "Making Renewable Supply Chains Sustainable: Blending Science with Good governance" which was held at the Habitat International Centre New Delhi on 16 November. Attending were 10 industry representatives, 10 government representatives and 20 international academics outside of ACES with discussions centred on "What is the road-map for joining up new technology with good governance and ethical materials sourcing?"

In addition members presented their research papers at international workshops with various stakeholders in the energy space present:

Hancock, L and N Ralph (2017) presented their paper on 'Big Energy and the Political Economy of Energy

Policy in Australia: Future High Voltage Superpower or Backwater State?' at the International Studies Association (ISA) 'Understanding Change in World Politics', 58th Annual Convention, Baltimore, United States, 22-25 February.

Ralph, N & L. Hancock (2017) paper entitled "Alternative energy technologies, supply chains and corporate peace-building" was presented to Department of Politics and International Studies (POLIS) at Deakin University, Melbourne, 21 April.

Hancock, L., N. Ralph & S.H. Ali (2017) presented the paper 'Bolivia's Lithium Frontier: Can Cleaner Technologies Harness a Mineral Development Boom?' at the Sixth International Workshop: Advances in Cleaner Production held in Brazil, 24-26 May.

CI Zhang hosted a poster presentation at the 2nd Annual Innovation Showcase Symposium, an event organised by the Chemicals and Plastics Manufacturing Innovation Network, enabling ACES research to be showcased to a distinguished audience of government and industry leaders, 2nd July.

Ralph, N., Hancock, L. & MacFarlane, D (2017) presented their paper on "Can Australia Become an Alternative Energy Superpower? Political Economy and International Relations Impacts of Australia's Potential Alternative Energy Exports to Asia" at the 'Democracy and Populism: A New Age of Extremes?' conference, Australian Political Studies Association, 25-27 September, Melbourne.

GOVERNMENT RECOGNITION OF ACES RESEARCH EFFORTS

Alan Finkel, Chief Scientist of Australia, made mention of ACES CI Prof Robert Kapsa and the ACES research, in his Merson Lecture given at the Queensland Brain Institute, University of Queensland, 24 October.

Excerpt from the Merson lecture: "And what extraordinary opportunities might

arise for breakthrough thinkers, like the members of Robert Kapsa's [ACES CI] team whom I met at St Vincent's Medical Research Institute in Melbourne.

They are well aware that the inability of axons to adhere to metal electrode surfaces is the limiting factor for connecting single neurons to electronic circuits.

Their prototype uses an intermediate layer of muscle cells, which happen to adhere to metal electrodes much better than do neurons. The muscles trophically attract axons to form neuromuscular junctions and presto – a stable connection to individual neurons might be possible."

Paul Scully MP member for Wollongong gave a speech to the NSW parliament on 21 November 2017. He acknowledged and congratulated Prof Gordon Wallace who was named 2017 NSW Scientist of the Year.

Excerpt from Paul Scully's speech: 'What a fitting tribute to a lifetime spent pursuing scientific research and inspiring students around the globe....his work in electromaterials science and his innovative use of nanotechnology sets him apart from many others. Gordon has focused on how he can translate his and his team's research work into commercial reality because he knows the value of a research breakthrough is multiplied if it can be used to change lives'.

Sharon Bird MP Federal Member for Cunningham also congratulated Gordon in her speech to parliament. "This week my local area has excelled in science achievement. I couldn't be prouder-and I'm sure the member for Whitlam joins me in that.... Professor Gordon Wallace, an outstanding scientist and leader from the University of Wollongong, was announced as the 2017 New South Wales Scientist of the Year for his groundbreaking work on implantable 3D printed structures containing living cells to regenerate damaged cartilage, bones and even organs. And Gordon paid great tribute to his whole team in receiving the award. We are very proud of them.

My sincere congratulations go to Neil Bramsen and Gordon Wallace, leading in science from Wollongong."

ACES engaged in the Research Showcase event on 7 September 2017 at Parliament House in Canberra. This event, jointly organised the ARC and Science and Technology Australia, was an opportunity to network with parliamentarians and key staff. Simon Birmingham, Minister for Education and Training and Senator for South Australia, stated during his address "So today, in opening this discussion, the event here celebrating centres of excellence that will enable you to share some of your breakthroughs with the leaders of our nation and enable them to share and answer some of your questions about the policies and direction of our nation, I want to thank you for the ground-breaking work that you do – ground-breaking work that has a real world impact in Australia and across the world. It does change lives; it does make a difference..."

RESEARCH IN ACTION

ACES members continued to work towards translation of the research with many end-users.

ALLEGRA ORTHOPEDICS

ACES-ANFF materials node partnership continues working towards the production of bone scaffold structures.

AQUAHYDREX PTY LTD

Through building on fundamental discoveries on nanostructured catalysts, coupled with our ability to create translational devices, AquaHydrex was born. AquaHydrex is now in its 5th year of operation and ACES hydrogen-production technology is being used to produce clean energy solutions in this spin out company. In 2017 ACES continued to support Aquahydrex through ARC linkage funded activities (Grant LP13010113, 'Highly-efficient, reversible fuel cell').

AUSTENG

ACES members collaborate on research

into hazards to the environment and equipment relating to creating pacemaker batteries.

BILL & MELINDA GATES FOUNDATION

ACES' ultra tough hydrogel materials continue to be developed for use as a condom in a Bill & Melinda Gates Foundation grant project awarded to UOW to further develop a condom design.

CEREBRAL THERAPEUTICS

ACES CI collaborates with cerebral therapeutics a clinical stage pharmaceutical company treating patients with refractory CNS Diseases by utilising reformulated off-patent drugs delivered to the ventricles of the brain (targeted Central Nervous System Drug Delivery) in order to bypass the Blood Brain Barrier.

COOK MEDICAL

ACES is undertaking a feasibility study for coatings on stents.

DSTG

ACES researchers at Monash, UOW and Deakin have undertaken several projects on energy storage and electrochemical sensing technologies. CI Forsyth has been awarded a grant (2016-2019) with DSTG (Forsyth, Somers, Catubig) for \$240K; UOW (Wang and Wallace) 2017 for \$35k; UOW (Molino) 2017 for \$35k.

ENWARE

ACES members are involved in the development of material technologies related to tapware and plumbing systems.

"We wanted to be knowledge leaders, so we had to acquire that knowledge but we couldn't do it ourselves. Hence, we become involved with ACES. All of a sudden we were part of a community of experts well outside our field of knowledge, all trying to solve the same problem. What seemed to be impossible dreams were becoming realities, just from that knowledge in a room."
Jason Hinds, Enware

IMAGINE INTELLIGENT MATERIALS

ACES CIs continue to work closely with IMAGINE IM. Based on patented ACES graphene processing technology, the start-up IMAGINE IM was born. In 2015-17, ACES provided interactions with IMAGINE ranging from know-how process information transfer through to materials supply and materials coating via research collaboration and a materials transfer agreement.

LINCOLN AGRITECH LTD

ACES members collaborate on fibre materials production and application.

MEDTRONIC

ACES CI Cook has a project in collaboration with Medtronic (MN, USA), where they are conducting a first-in-man feasibility study of a novel deep brain stimulator for the treatment of epilepsy seizures.

ONESTEEL

ACES members work on the development of improved coatings.

RESERVE BANK OF AUSTRALIA

ACES members collaborate on electromaterial research.

ROMAR

ACES - ANFF materials node work on 3D printing of biocompatible flexible materials.

SMR AUTOMOTIVE

SMR are moving from automotive component manufacture into the biomedical area through manufacturing the Biopen.

TOYOTA MOTOR ENGINEERING AND MANUFACTURING

ACES members are involved in the development of ionic liquids and batteries.

TRAJAN SCIENTIFIC AUSTRALIA PTY LTD

ACES members are involved in developing a method for specialty chemical purification.

VENUS SHELL SYSTEMS (VSS)

This Wollongong regional manufacturer is jointly funding a PhD scholarship at UOW. The collaboration is progressing to develop new methods to enable the extraction of high quality biomaterials (ulvans) from seaweed for wound healing.

"We are growing, extracting and fractionating now at a pilot commercial scale, and ACES is an invaluable partner in further modifying and fabricating wound healing dressings potentially from the seaweed," Pia Winberg, Venus Shell Systems.

THE ACES-ANFF APPROACH: CUSTOM 3D PRINTING SOLUTIONS INTO CLINICAL ENVIRONMENTS

Inspired by Prof Graeme Clark of Bionic Ear fame, ACES researchers have embarked on research into the use of newly discovered materials in medical applications. This has necessitated the parallel development of additive fabrication tools, such as customised 3D printing, in partnership with the ANFF Materials Node. Based on our clinical engagement approach developed at St Vincent's Hospital Melbourne with Prof Peter Choong and Prof Mark Cook, we have established a vibrant national and growing international network.

CRITICAL CLINICAL PARTNERSHIPS

This amazing journey, facilitated by converging technologies, has been driven by clinical partnerships with:

- Prof Chris Baker (St Vincent's Hospital Melbourne) to develop 3D printed scaffolds for wound healing.
- Prof Mark Cook (St Vincent's Hospital Melbourne) to develop implantable material structures for localised release of anti-inflammatory and anti-epileptic drugs.
- Prof Peter Choong (St Vincent's Hospital Melbourne) to develop 3D printed structures to facilitate adipose stem cell transformation to hyaline cartilage.
- Prof Stephen O'Leary (Eye and Ear

RESEARCH IN ACTION

3D BIOPRINTER DESIGNED AND BUILT BY UOW'S ACES TEAM OFFERS DIABETES CURE

Challenge: Currently only the most severe cases of Type 1 Diabetes can be treated with islet cell transplantation from human donors. These donor islet cells restore the diabetes sufferer's ability to produce insulin and regulate their blood sugar levels.

Solution: To improve the effectiveness of islet cell transplants by encapsulating donated islet cells in a 3D printed structure, to protect them during and after transplantation.

How? ACES/ANFF researchers at UOW have designed and built a customised 3D bioprinter that promises to revolutionise treatment for people with Type 1 Diabetes. The Pancreatic Islet Cell Transplantation (PICT) 3D Printer will be capable of delivering insulin-producing islet cells from a protective bioink into a printed scaffold suitable for transplant. The printed transplant material has the potential to reduce the likelihood of rejection as a patient's own cells could be used. Also, because multiple cell types can be printed in the same run, endothelial cells – essential for installing blood flow to the grafted islet cells – can be implanted, improving islet cell survival.

Engagement: ACES in collaboration with Prof Toby Coates' team at Royal Adelaide Hospital and ANFF technicians. *"The PICT Printer will allow us to make customised organs, mixing donor with recipient cells in a unique 3 Dimensional way to provide completely new composite 'organoids' for experimental transplantation,"* Prof Coates said.

Impact: The development and hand over of the PICT Printer marked a new era in manufacturing as ACES researchers continue to expand their clinical connections and explore new opportunities for customised 3D bioprinters and bioink formulations.

Hospital) introducing new materials to facilitate electrode-cellular communication for the bionic ear and to develop new controlled drug delivery systems.

- Prof Michael Coote (Eye and Ear Hospital Melbourne) to develop novel glaucoma implant configurations using 3D printing.
- Prof Toby Coates (Royal Adelaide Hospital) to develop 3D printed structures as vehicles for islet cell transplantation.
- Prof Gerard Sutton (Lions NSW-Eye Bank Sydney) to develop 3D printed structures for corneal regeneration.
- Prof Stuart MacKay (Wollongong Hospital) to develop 3D printed airway models – understanding and rectifying collapse to treat sleep apnoea.
- Prof Morteza (Mori) Aghmesheh (Wollongong Hospital) to develop 3D fabricated systems for controlled delivery of multiple drugs for cancer treatment.
- Dr Payal Mukherjee (RPA Institute of Surgery/Sydney Adventist Hospital) to develop 3D printing techniques for prosthetic ears.

In July 2017 ACES celebrated an exciting collaboration that looks to the future of corneal health. ACES joined forces with the Lions NSW Eye Bank and Sydney University's Corneal Bioengineering Group to implement an exciting new collaborative corneal bioengineering program.

These organisations will work together to revolutionise the treatment of corneal ulceration by developing a novel device, the 'iFix Pen', which will deliver a special bioink formulation that has the capacity to facilitate healing and prevent infection in treating the disease.

ACES joined forces with Prof Sutton and his team to bring together the skills needed to tackle this challenging area. Corneal ulceration is a significant cause of severe eye pain, visual morbidity and visual loss. It accounts for 55,000 hospital admissions in Australia each year. It can be complicated by infection and in extreme cases melting of the eyeball. Current treatments involve antibiotics and the use of a contact lens.

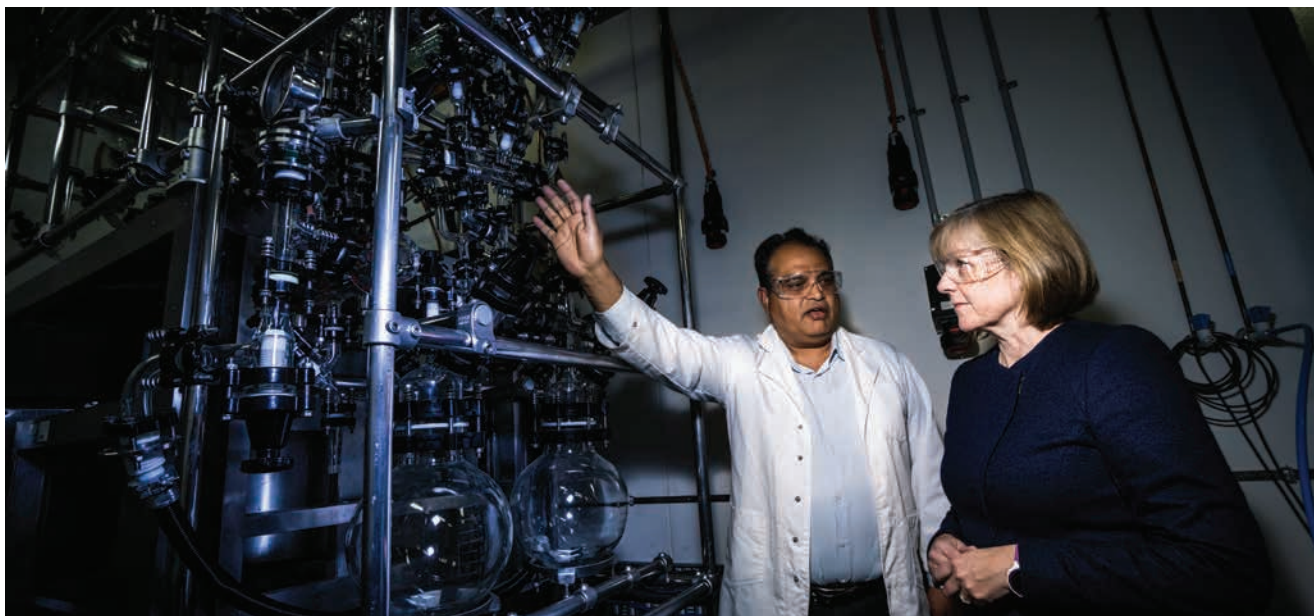
"We are confident of having real impact in a short period of time".

Prof Gerard Sutton was the winner

of the inaugural 'Big Idea' research funding challenge hosted by Sydney Research. The team developing the device won \$44,125 in the inaugural 'Big Idea' research funding challenge which kicked off Sydney Local Health District's 2017 Innovation and Research Symposium. Watch Prof Sutton on <https://youtu.be/VjGApRCU33k>.

In an Australian first, in December 2017 researchers from ACES designed and built a customised 3D bioprinter that promises to revolutionise treatment for people with Type 1 Diabetes. The Pancreatic Islet Cell Transplantation (PICT) 3D Printer will be capable of delivering insulin-producing islet cells from a protective bioink into a printed scaffold suitable for transplant.

The PICT 3D Printer was officially handed over to South Australian Minister for Health Peter Malinauskas for use at the Royal Adelaide Hospital (RAH) on 6 December 2017. The Royal Adelaide Hospital is the first hospital in Australia to receive this cutting edge biomedical printing device. The PICT Printer will be developed further with funding from an Australian Research Council's Linkage, Infrastructure,



Equipment and Facilities (LIEF) grant.

A 3D printer for printing prosthetic ears is under development – courtesy of a Garnett Passe and Rodney Williams memorial foundation funding grant awarded to Dr Payal Mukherjee (RPA Institute of Surgery/Sydney Adventist Hospital).

Prototype Biopens have been developed in collaboration with 3D Biofab facility, which opened at St Vincent's hospital Melbourne in 2016, and SMR automotive. ACES is a partner of the 3D Biofab facility.

Thanks to the critical linkages and connections with clinicians, translation of the vast body of knowledge generated from ACES is a step closer to changing the landscape of healthcare as we know it.

CAPABILITY - BUILDING FACILITIES

New facilities provide catalytic sites for the merging of fundamental research, end users and commercial opportunities. ACES has been an integral component in the establishment of new facilities such as the BatTRI Hub at Deakin, the

3DBiofab facility at St Vincent's Hospital in Melbourne with a view to attracting further end-user engagement. Through an investment by TNVP new research facilities were established in 2014 in the Illawarra to house ACES spinout company AquaHydrex.

In 2017 ANFF provided a new bioreactor and fibre spinning facilities at ACES UOW.

"The new reactor and fibre spinning facilities provided by ANFF will make it easier for ACES to perform the very best science by supporting their incredible research and strengthening the essential links between science, engineering and manufacturing," said ANFF CEO Rosie Hicks.

The new facilities will enable 50 litre reactions to produce kilograms of materials needed to formulate bioinks for 3D printing use in structures for islet cell transplantation, cartilage regeneration and wound healing projects.

The facilities will provide the ability to fabricate structures for use in wearable and implantable technologies for biomedical applications, including wearable energy and implants for tissue regeneration.

The enhanced fibre spinning capabilities will utilise some of the most recent

advances in materials science, such as graphene, to produce up to 100 metres per minute of fibres using electrospinning, melt and wet spinning, weaving, knitting and braiding technologies.

END USER BRIEFINGS

ACES disseminates knowledge to existing industry partners through information sessions, workshops and web-portal sessions. ACES works hard to raise the Centre's visibility outside the academic sector. The aim is to (a) showcase ACES research skills, technologies and facilities as well as to (b) understand how ACES can better facilitate pathways and connections to maximise their research impact.

To this end over 86 business briefings took place via visits or teleconferences to ACES (see Appendix 2) and a further 26 briefings by ACES members visiting personnel within the government, industry or part of the business community (see Appendix 3).

ACES also hosted 10 events (see Appendix 4) to raise awareness of the facilities and research activities amongst end-users.

Global Engagement

ACES STRATEGIC PLAN GOAL 4: GLOBAL ENGAGEMENT

We are committed to connecting with the international research community and strategically expanding our global sphere of influence by investing in partnerships which add value to ACES.

TOWARDS OUR GOALS

ACES international linkages comprise mostly researcher to researcher collaborations. This is illustrated with ACES having published 103 (57.5%) journal articles with international co-authors, from 30 countries and 157 institutions (Schematic 2), and 398 (55.1%) since 2014.

The average number of citations received by publications that have international co-authorship, and by inference the collaboration impact of that research, is greater (impact 11.5; ACES 2014-17) when compared to publishing with national (impact 9.2; ACES 2014-17) or institutional (impact 6.5; ACES 2014-17) co-authors or as an independent researcher (impact 1.8; ACES 2014-17) (Table 5).

The ACES Global Engagement Group (GEG) determined that the most effective way to add to the international linkages program was to identify and pursue strategic alliances with appropriate Centres overseas.

A Memorandum of Understanding (MOU) has been signed in 2017 with:

1. CIC Energigune (The Energy Cooperative Research Centre in the Basque area), Spain.
2. The Institute of Materials Jean Rouxel, researchers from both the

Table 5: Publication and citation activity for ACES affiliated publications 2014-2017 (Source, Scival based on SCOPUS data 9.1.18)

	2017	2014-2017
Number ACES publications (SCOPUS)	190	745
Number of ACES publications (SciVal)	179	722
Number of citations	198	7,345
Number of citing countries	39	77
Outputs in top 25% most cited	179 (100%)	556 (77%)
Field Weighted Citation Impact (#FWCI – for articles and reviews)	1.57	1.84
International collaboration	103 (57.5%)	398 (55.1%)
International Field Weighted Collaboration	1.39	1.39
National Collaboration	60 (33.5%)	256 (35.5%)
National Field Weighted Collaboration	1.4	1.4
**Collaboration Impact – International	1.1	11.5
**Collaboration Impact – National	1.3	9.2
**Collaboration Impact – Institutional	0.4	6.5
**Collaboration Impact – Single authorship	0.5	1.8

CNRS (The French National Centre for Scientific Research) and the University of Nantes, France.

3. Nanotechnology & Integrated BioEngineering Centre (NIBEC), Ulster University, Ireland.
4. Yonsei University, South Korea, on 3D bioprinting.
5. Sunchon University, South Korea, on printed electronics and wireless electrochemistry.
6. Istituto Ortopedico Rizzoli, Bologna, Italy a collaboration agreement on 3D bioprinting.

ACES, through Deakin University, are also now involved in a European

Masters course 'Materials for Energy Storage and Conversion'. This two-year Master program in Materials Science and Chemical Engineering involves 8 universities from 6 countries (France, Poland, Slovenia, Spain, US and Australia). Expanded research links to these European universities are expected to follow as a consequence.

ACES EXPANDING GLOBAL COLLABORATIONS

ACES continued to open its doors for collaborators and new partnerships in 2017.

ACES ASSOCIATE DIRECTOR PROF MARIA FORSYTH FORGES LINKS IN SPAIN DURING SABBATICAL

Associate Director of ACES, Maria Forsyth, formed strong international connections during her nine months spent in Spain during 2017.

Maria was initially based at POLYMAT in the Universidad del País Vasco (The University of the Basque Country) in San Sebastian working with Prof David Mecerreyes' innovative polymers group. David was a Deakin University Thinker in Residence – meaning this was a reciprocal visit for Maria to further strengthen that collaboration in polymer electrolytes for battery applications. There are at least two new project collaborations developing with Dr Luca Porcarelli and Dr Jaime Martin Perez who have exquisite control over polymer nanostructure structure and surface chemistry.

ACES Deakin are studying polymer/plastic crystal composites and new ion gels based on ionic liquid electrolytes, from both a fundamental understanding of ion dynamics in these materials through to their applications in devices. This is in addition to existing ACES collaborative projects on sodium battery polymer electrolytes - the topic of Asier Fernandez PhD in collaboration with CIC energiGUNE, Deakin University and POLYMAT. Asier Fernandez spent a six month internship with Deakin on an ACES project on Zinc batteries in 2016.

Dr Matze Hilder, a former ACES graduate, arrived for his second stint at the CIC energiGUNE in April to work with Asier.

The CIC energiGUNE, situated in Vitoria-Gasteiz, are research collaborators on ARC Discovery Projects and with ACES.

Deakin University has established a research connection with Tecnia after initial visits by Maria in 2014. A joint scientific workshop was held to establish potential collaboration areas and led to the signing of a Memorandum of Understanding (MOU).

There is strong synergy between

several Tecnia research programs and ACES, in particular in membranes for gas separation and water purification, ionic liquids and electrochemistry, energy storage and corrosion.

ACES signed an MOU with CIC energiGUNE in 2017 to facilitate further staff and student exchanges from 2018 in the area of energy storage.

ALLIANCE STRENGTHENED BETWEEN ACES AND HELMHOLTZ ZENTRUM BERLIN

ACES researchers Dr Alexandr Simonov and Prof Douglas MacFarlane were invited to visit Helmholtz Zentrum Berlin (HZB) in June to build on the strategically important alliance between ACES and German specialists in advanced spectroscopic analysis.

A strategic agreement between ACES and HZB has been achieved with the aim of intensifying student and staff exchange between Australia and Germany starting from 2018. A formal collaboration is expected to be strongly supported by the Helmholtz International Research School program. https://www.helmholtz.de/en/jobs_talent/funding_programs/doctoral_students/helmholtz_research_schools/

The ACES-Germany link will provide researchers with the opportunity to include high-end *ex-situ* and unique *in-situ* electrochemical X-ray absorption spectroscopy, EPR and X-ray photoelectron spectroscopy.

In-situ spectroscopic analysis of electromaterials under real operating conditions provides unprecedented insights into material performance.

ÅBO AKADEMI UNIVERSITY, FINLAND

3D printing capabilities and expertise in developing hydrogels for wound healing attracted two senior researchers from Finland on a six month exchange to ACES in 2017.

Dr Wang is working with bioactive glasses and exploring their use to release

therapeutic ions for wound healing.

"The reason I've come to ACES is for its expertise in 3D printing hydrogels that can house the tiny glass particles. The idea is that when the resulting gel is applied to a wound, the glass particles begin to release inorganic ions, which are known to help the body heal."

Dr Chunlin Xu is on a similar path, although he uses a natural polymer called cellulose that is one of major components in wood, as the basis for his wound dressing.

Cellulose is the most abundant natural polymer on the earth. Moreover, the biocompatibility of cellulose and its use in wound care is well documented, and Dr Xu is interested in leveraging these benefits in a 3D printed gel.

A collaboration agreement between ACES and Åbo Akademi University is currently being negotiated.

PROF JARI HYTINEN FROM TAMPERE UNIVERSITY OF TECHNOLOGY FINLAND JOINED ACES FOR TEN WEEK SABBATICAL

Prof Jari Hyttinen heads up the Computational Biophysics and Imaging Group (CBIG) which aims to deliver new knowledge and methods for future personalised medicine through the development of 3D bioimaging, bioelectronics and computational modelling tools for new personalised treatments, diagnostics and drug discoveries, especially those enabled by tissue engineering and stem cell research. The group is part of the BioMediTech Institute and Faculty of Biomedical Sciences and Engineering at Tampere University of Technology.

Working in stem cell research, Jari is particularly interested in the ACES 'brain on a bench' project and 3D printing of human iPSCs.

In addition to his other positions at Tampere University of Technology, Jari is the past President of the European Alliance of Medical and Biological Engineering and Science (EAMBES), a



Schematic 2: In 2017 ACES published 103 publications with international co-authors, from 30 countries and 157 institutions (number of institutions per country shown as numbers in brackets)

Bangladesh (2)	Canada (2)	China (30)	Denmark (1)	Egypt (1)	Finland (6)	France (2)
Germany (6)	India (6)	Iraq (1)	Ireland (2)	Italy (2)	Japan (11)	Jordan (1)
Malaysia (6)	Netherlands (5)	New Zealand (1)	Norway (1)	Portugal (1)	Russia (1)	Saudi Arabia (2)
Singapore (2)	Spain (8)	South Korea (10)	Sweden (2)	Switzerland (1)	Thailand (3)	Turkey (1)
UK (10)	USA (28)					

not-for-profit international organisation that unites most scientific societies and academic and research institutions located in Europe involved with Medical and Biological Engineering and Science.

PARTNER INVESTIGATORS

ACES has 5 partner investigators, Dublin City University, University of Warwick, Friedrich Alexander University, Hanyang University and Yokohama University, that enhance the specialist expertise available to our researchers and ACES access

to world class facilities. Our partner investigators have also been engaged with ACES through joint international workshops and embassy events as well as exchange visits.

ACES YOKOHAMA UNIVERSITY

PI Watanabe and ACES work together on the development and use of a new range of ionic liquid electrolytes and their application in various electrochemical devices focusing on Synthetic Energy Systems.

Following on from the International

Battery Association Meeting ACES held a one day workshop 'Energy Related Materials and Devices' with our international partner at Yokohama National University on 11 March. In attendance for the workshop were 16 ACES personnel or affiliates (Deakin, Monash and UOW) presenting their research. The event attracted more than 50 participants, including researchers from Tokyo Metropolitan University, Yokohama National University and Dr Wes Henderson in his role of International Program Manager - Energy Transport and Storage from the U.S. Army Research Office in Japan.

ACES Partner Institutions	Country	Areas of Expertise
Dublin City University	Ireland	smart materials, stimuli responsive materials, sensors, health, and the environment
University of Warwick	England	electrochemistry
Friedrich Alexander University	Germany	molecular materials and nanotechnology
Hanyang University	South Korea	soft robotics and biomedical engineering
Yokohama University	Japan	ionic liquids and their electrochemical and materials applications, expanded in 2016 to also cover biomedical applications

AI Junji Fukuda works with ACES in the area of bioprinting and biobatteries. Both A/Prof Kukuda and his student Dina Myasnikova visited ACES UOW 24-25 January to discuss ACES project progress and participate in round table discussions with the ACES Synthetic Biosystems team.

ACES ECR Binbin Zhang visited A/Prof Fukuda 17-24 September to conduct experiments on electrostimulation of cells. Binbin began her two year fellowship working with AI Junji Fukuda at YNU from November 2017.

ACES DUBLIN CITY UNIVERSITY

ACES: The Irish Dimension Celebration event kicked off the year with over 50 people hearing about the success of the partnership on 7 February in Wollongong. The National Centre for Sensor Research (NCSR) at Dublin City University, at which ACES PI Prof Dermot Diamond is Director, is a world renowned, large scale, multidisciplinary research facility comprising custom designed laboratories, a range of specialist support units and equipment, and dedicated technical and administrative staff.

Through ACES, the long established DCU-UOW collaboration has broadened to involve additional faculty members

and collaborating organisations in Australia, Ireland and across Europe. For example, through ACES PI Diamond has been able to establish exchanges and joint research activities with Prof Douglas MacFarlane (ACES Monash University) and Prof Brett Paull (ACES University of Tasmania).

DCU has been able to build stronger global networks, raising their international profile and potential socio-economic impact. As a consequence of the ACES-DCU partnership researchers at DCU-INSIGHT have assisted Australian companies including Enware and Scintilla MicroSampler Pumps. On the flip side ACES researchers have been able to interact with local Irish companies such as Shimmer (wearable sensors for personal health and activity tracking) and Tellabs (environmental sensing).

The second function between the partners in 2017 saw researchers from ACES and their European collaborators meet in Dublin, at DCU on 25 May, for a one day symposium 'Beyond Bionics' to explore converging technologies and emerging opportunities.

The symposium was followed by showcasing the next generation of bionic devices from Australian-Irish research at the Australian embassy in Dublin, hosted by the Australian

Ambassador to Ireland, Mr Richard Andrews.

Rapidly converging technologies mean that these opportunities are right in front of us, presenting the ability to enhance medical treatments for patients, as well as new commercial opportunities for industry.

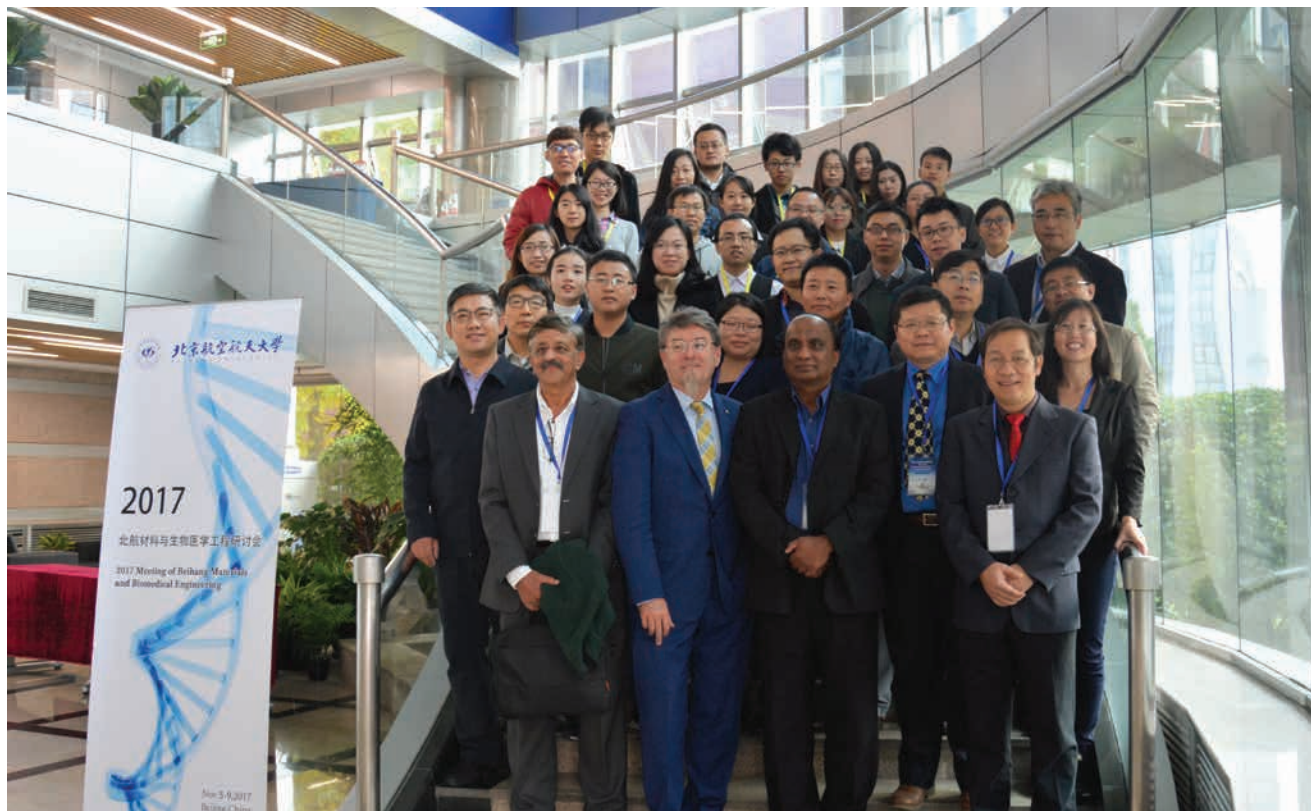
ACES AI Robert Forster is collaborating with ACES researchers on the development of characterisation tools as well as wireless bipolar electrochemistry.

ACES continued to work with DCU AI Aoffie Morrin on sensing technologies for incorporation into wound healing systems. DCU postgraduate student Eoin Murray, working with ACES AI Morrin, spent three months at ACES UTAS node working on portable chromatographic systems for nutrient monitoring, January-March.

ACES HANYANG UNIVERSITY

Hanyang University takes pride in its strong industry connections, and they value the new opportunities to build new partnerships with Korean companies through the ACES connection. In particular, ACES' strong international profile in 3D printing, especially bioprinting, has received significant attention.

In April 2017 ACES and partner Hanyang University organised a joint ACES-ASAN Medical Centre (AMC) workshop: 'Printing Parts for Bodies Symposium' in Seoul at Yonsei University. Following this event an ACES showcase was held at the Australian Embassy in Korea. Representatives from Hanyang University, Gangneung Wonju National University, KIMM, Dongguk University, Seoul National University, Konyang University, Jeju National University, National Research Foundation of Korea, KIST, Yonsei University College of Medicine, ASAN medical centre, Digital Times, The Electronic Times, LG Chem, Samsung SDI, Korea Biotechnology Industry Organisation, InfoPia, Bit Computer,



I-Sens, Auto Industrial and Samsung electronics were in attendance.

Hanyang University's growing awareness of ACES activities, since joining as a partner organisation, has identified new opportunities within the ACES Synthetic Energy Systems and Synthetic Biosystems themes for them to engage. These areas have significant overlap with Prof Kim's interest in self-powered artificial muscles, biofuel cells and stretchable energy storage textiles.

ACES FRIEDRICH ALEXANDER UNIVERSITY

One of the key research priorities at FAU is Future Energy Materials that includes the Cluster of Excellence Engineering of Advanced Materials (EAM). It is this synergy of developing advanced materials for the creation of future energy systems that has established ACES as an important partner in helping develop FAU's research aspirations.

A major thrust of the FAU-ACES

collaboration addresses the expanding global need for energy by developing a groundbreaking platform to produce chemical fuels using solar energy.

To advance to such a level of sophistication, we have focused on future generation photovoltaics and on artificial photosynthesis to demonstrate both, very high conversion efficiencies and environmental sustainability, in producing fuels and electricity with energy costs comparable to current energy production from fossil fuels. This approach utilises the strengths of each institutions, the world class materials development and processing at ACES and the outstanding materials characterisation and fabrication at FAU.

ACES hosted the first joint FAU/UOW PhD candidate, Mr Markus Pfau, jointly supervised by PI Guldi and CI Officer for 2017, whilst he completed his final experimental work and thesis writeup.

PI Dirk Guldi visited Wollongong from 3 February for a month and again in September.

ACES researchers CI David Officer and senior researcher Dr Pawel Wagner from ACES UOW visited ACES node at Friedrich-Alexander University, Erlangen Germany to present a lecture and to discuss and review collaborative research plans in May. Dr Alexandr Siminov ACES Monash visited FAU in the second half of the year.

ACES WARWICK UNIVERSITY

Warwick Electrochemistry and Interfaces Group's (WEIG's) involvement in ACES is based around batteries and energy materials.

Thus far, the link has involved hosting several visitors, making available equipment and facilities, and supporting travel. Among visitors to Warwick have been Profs Maria Forsyth, Jie Zhang, Doug MacFarlane, and Alan Bond, together with student exchange visits.

The link with ACES Monash is particularly strong and includes a PhD student, Sze-yin Tan, jointly supervised by ACES PI Unwin, ACES

CI Zhang, ACES AI Bond and Julie Macpherson, who has benefitted from the links fostered by ACES as well as the Monash-Warwick Alliance. Sze-yin spent the last year of her PhD at ACES Monash. She graduated in 2017 and the work has led to a number of key publications. Dr Sze Tan is currently working at Imperial College as a postdoctoral fellow.

The participation in the Centre has been flagged in grant applications from WEIG, including the successful EU Marie Curie Fellowship Application made by Dr Cameron Bentley, a Monash Graduate, who now holds a fellowship at Warwick (until November 2018). Dr Bentley and Dr Andrew Basile (RMIT graduate and now a researcher at ACES Deakin) also held ARC Endeavour Fellowships at Warwick, in which the ACES involvement was highlighted.

ACES has been mentioned positively in successful applications to the Royal Society and Leverhulme Trust.

PUTTING ACES ON THE GLOBAL STAGE

In the quest to consolidate existing collaborations and to initiate new ventures in research, ACES members were actively out and about speaking of ACES New Dimensions to existing and potential collaborators as demonstrated by the information in the following tables.

PLENARY/KEYNOTE ADDRESSES

23 Plenary or Keynote addresses were given by ACES members in 2017—details are in Appendix 5.

INVITED TALKS AT INTERNATIONAL CONFERENCES

84 invited talks, of which ten were open to the public, were given by ACES members at International Conferences in 2017—details are in Appendix 6.

INVITED PRESENTATIONS

(I) DISTINGUISHED VISITOR LECTURES

3 invited 'distinguished visitor' lectures were given by ACES members in 2017.

MacFarlane, D (2017) 'Progress Towards Renewable Energy Storage as Hydrogen and Ammonia' - HZB Distinguished Lecture, Berlin, 13 June.

Coote, M (2017) was hosted for a week in September at the University of Tasmania at their inaugural 'Women in STEM' lecturer. Electrostatic Catalysis of Non-Redox Reactions at the Chemistry Seminar Series, School of Physical Sciences, University of Tasmania, 14 September.

Officer, D. L. (2017) 'Shining light on new materials: molecules to devices', 2017 Halton Lecture, New Zealand Institute of Chemistry Wellington Branch, Wellington, New Zealand, 8 November. *Open to the public.

(II) INVITED COLLABORATION VISITS

103 invited seminars and collaborative visits were given by ACES members in 2017 (Appendix 7). 69 were to overseas laboratories.

CONFERENCE PRESENTATIONS BY ACES MEMBERS

107 Conference presentations given by ACES members in 2017 (Appendix 8). Please note that presentations given by ACES members at ACES events are not included in any of these lists.

ENCOURAGING RESEARCH COLLABORATION

WORKSHOPS

The advancement of the scientific knowledge that ACES generates is an important component of Centre activities. ACES international conferences, symposia and events provide ACES students and ECRs are

given the opportunity to communicate their research in ACES showcase sessions and poster sessions at ACES events (15 events in 2017 see Appendix 9). Networking by ECRs and students with international guests is encouraged. Over the years, ACES has developed a reputation for not only excellence in the educational quality of its conferences, but also the collegial atmosphere.

We asked our attendees to the ACES International Electromaterials Science Symposium held in Wollongong in February 2017 to leave comments on our event.

"The Electromaterials Symposium was an excellent event, providing many opportunities to broaden one's scientific horizons as well as opening up new opportunities for collaborations. The breadth of content, from fundamental molecular properties through to solving clinical problems, was amazing and indicated the power of trans-disciplinary research collaborations. As a non-ACES researcher, a number of new collaborations was identified, which will be followed up and hopefully lead to positive interactions".... Getting postdocs and/or PhD students to present in 10 min was powerful, where we got to the real message of the study quite quickly." Damien Arrigan, Curtin University.

"Content was diverse and interesting, experience was great, networking was good. ACES showcase presentations were well conceived and realised. Had several very interesting discussions with some researchers working in similar fields, and some also very interesting discussions with some researchers from overseas who were working in different fields. Overall happy with the networking component." Srdjan Begic, PhD student Deakin University.

"It is my second time I have attended the event and it is worth the long trip from Italy. The content and the quality of the presentations are outstanding. The event is extremely well organised, the facilities are superb. This event provide an unique chance for high level, informal and direct contact



ACES Associate Director, Maria Forsyth, formed strong international connections during her nine months spent in Spain during 2017. "The Whole of the Moon" exhibition reflects Maria's passion for clean energy powering the world. Photo credit: Donna Squire

with the presenters.....The showcase presentation is extremely important because provided a concise description of the topic and the quality of the ACES research. It is important because is a good incentive for interdisciplinary collaborations....The event has the perfect balance between frontal presentations and informal time to comment and exchange ideas." Enrico Lucarelli, Rizzoli Institute.

"I have found the Electromaterials Science Symposium to be one of the best conferences I have attended in the last couple of years. I really appreciate the variety of topics covered and the quality of the invited presenters it is truly fascinating and there is something here for everyone. As a presenter it has opened the possibility of several collaborations with UniMelb, UoW and St Vincent's on areas where previously I may not have considered.... The quality of the ACES showcase presentation was outstanding and demonstrated the diversity of activities undertaken at within ACES. The format was also well

considered and enjoyable..."

David Nisbett, ANU

"What a great meeting last week. Thanks to all our ACES friends for hosting this."

Mike Lyons Trinity College Dublin.

VISITING ACADEMICS

44 International academics and 27 interns, undergraduate or post graduate students were welcomed to ACES in 2017. Activities include (i) working alongside ACES members to further collaborative research or (ii) for the opportunity to present a research seminar to ACES members and view ACES facilities as a first step towards engagement. For the list see Appendix 10.

ACES involvement in international funding schemes with collaborators allows for ACES to broaden the collaborative research base. For example, ACES members are part of the 7th Framework Programme - Marie Curie Action International Research Exchange Scheme IRSES-AMBIPOD project (2014-2017): Dr Pawel Wagner

(ACES SRF) hosted five researchers at ACES/UOW as part of the "Multicoloured Ambipolar Conducting Polymers for Single Polymer Optoelectronic Devices" (AMBIPOD) project, which is funded under 7th Framework Programme -Marie Curie Actions.

The project aims at development of novel conjugated polymers featuring multielectrochromic properties that can find application in polymer electrochromic or electroluminescent devices. The aim is to obtain new π - conjugated polymers, containing both electron-donor and electron-accepting units by first selecting their monomeric precursors using quantum chemistry tools.

As part of the BIOFABrication for Future Manufacturing (BIOFAB) Master of Philosophy program ACES hosted several students in 2017 (refer to research training chapter for details).

35 national academic guests were also welcomed. The list can be viewed in Appendix 11.

Communications

ACES STRATEGIC PLAN GOAL 5: COMMUNICATIONS

Our goals are to:

- Develop communication skills and protocols that ensure awareness of and commitment to the ACES vision across the research, research training and commercialisation platforms within the Centre.
- Create effective interfaces that disseminate the science and promote engagement effectively targeting the different stakeholders - in commercial sectors, healthcare, government and the community.

Our target audience is all ACES stakeholders - the global research community, students, investors, government and regulators and the community.

TOWARDS OUR GOALS

Effective communication is a critical component of all the strategic goals of ACES.

- Enables ACES to transfer the continually growing body of fundamental knowledge gained through undertaking our research to stakeholders and the broader community
- Ensures an increased level of awareness, understanding and support among various stakeholders and the community
- Enhances relationships between ACES and stakeholders: (i) raising the profile of ACES thereby assisting in identifying opportunities to progress the work and identify potential

partners to translate the research as well as (ii) reducing the scope for 'misinformation' about the research and research outcomes.

- Assists ACES to attract quality student and staff to the Centre – our next generation research leaders!
- Raises the profile of ACES facilities and our members and their research which in turn helps the Centre to attract potential collaborators.

IN THE HEADLINES

2017 ACES Media Summary

212 On line stories

33 Print stories

26 Radio interviews

24 TV appearances

BIOFABRICATION

The popular topic of BioPrinting – the process of 3D printing 'parts for bodies' – received regular media coverage throughout 2017.

In an Australian first, researchers from ACES have designed and built a customised 3D bioprinter called the Pancreatic Islet Cell Transplantation (PICT) which will be capable of delivering insulin-producing islet cells from a protective bioink into a printed scaffold suitable for transplant. The PICT 3D Printer was delivered to the Royal Adelaide Hospital – the first hospital in Australia to receive this cutting edge biomedical printing device and the story featured on *ABC Radio Adelaide Talkback*, *The Adelaide Advertiser* and three TV news broadcasters - *7 News Adelaide*, *Channel 9 Adelaide* and *Ten Eyewitness News Adelaide*.

In July the team behind the Biopen made up of researchers from ACES at UOW, St Vincent's Hospital Melbourne and the University Of Melbourne Department Of Surgery were named as finalists for the prestigious Eureka Prize for Excellence in Interdisciplinary scientific research – for their cutting-edge handheld 3D printing device. The device uses conventional 3D printing to create scaffolds that facilitate cartilage regeneration from adipose (fat) stem cells. This was developed with a view to preventing osteoarthritis and will have a significant impact on those suffering from the debilitating and painful condition. *The Illawarra Mercury* and *ABC Radio Illawarra 'Mornings'* both covered the nomination for the Eureka Prize.

Prof Wallace paid tribute to the diverse skills of materials scientists, cells biologist, mechatronic engineers and clinicians who worked on the project for a "significant number of years."

ABC did a roundup of Eureka Prize nominees including the ACES collaborative work towards the Biopen – 'Biopen doodles could erase arthritis' (<http://www.abc.net.au/news/2017-08-30/eureka-prize-2017-finalists-the-years-best-in-science/8833650>). This achievement was also covered by *ABC Radio Illawarra*, *ABC News online* and the *Illawarra Mercury*.

3D printing has been used to create personalised surfboard fins to help surfers improve their performance and this has again been news. The 3D printing capabilities from the ACES-ANFF partnership underpin the project, led by ACES CI Prof Marc in het Panhuis. Coverage was extensive - Television *Channel Nine Illawarra* (<https://www.facebook.com/9NewsIllawarra/videos/1908234542776139/>), radio *Talking Lifestyle - Talking technology*, *ABC Radio South East*, *Radio New*



Zealand's *ThisWayUp*, and in print or on the web *Via Sittard-Geleen*, *Econo Times*, *The Conversation*, *3D printing industry*, *EIS news* and *Inside Science*.

SYNTHETIC BIOSYSTEMS

ACES research on 3D Bioprinting Human Induced Pluripotent Stem Cell Constructs for disease modelling, driven by CI Crook, realised a lot of press - *WIN Illawarra*, *ABC News 24*, *ABC Online*, *ABC Radio Illawarra*, *ABC The World Today*, *3D Print*, *All3DP*, *Smart Design Labs*, *Student Society for Stem Cell Research*, *BCC Research*, *Australian Manufacturing*, *3D printernet*, *Advanced Science News*, *Stem Cells daily*, *Cells4Life*, *Drupa*, *LCGC Europe*, *Get Stem*, *3D printing industry* and *ABC radio*.

ACES work towards 3D printing neural tissues was also mentioned in *Science Bites* (<https://today.mims.com/3d-printed-brain-tissue-to-produce-neurotransmitters-epileptic-seizures-reduced-with-mathematical-modelling-strategy>)

Work by ACES collaborators in Melbourne was featured on *Channel 10 Scope* (Season 4 Episode 12). ACES RF Dr Justin Bourke ACES Melbourne and Dr Anita Quigley ACES UOW make appearances in the segment 'Senses' which aired 19 August.

SOFT ROBOTICS

ACES researchers working on soft robotics were in the news with *3D Print.com*, the *Illawarra Mercury* and *UOW's The Stand* magazine reporting on the unveiling of a new soft robotic hand prototype that could return full human movement and the sense of touch to those who have lost limbs and tissues.

An article also appeared in the *Geelong Advertiser* about ACES soft robotic hand researchers working with Deakin University and the CSIRO innovation hub to develop safe and reliable batteries to power the prototype and this work was also mentioned in *COSMOS* magazine. ACES AI Dr Robert Kerr from the BATRIHub was interviewed.

SYNTHETIC ENERGY

BETTER BATTERIES

A topic that has attracted attention is the use of silk for biodegradable batteries. ACES researchers built a battery with electrodes and a solid electrolyte out of silk with their work featured in the scientific publication *Chemical Engineering News Online*.

Previous attempts at making biodegradable, dissolvable batteries using natural, biocompatible materials for the electrodes and electrolytes were less efficient. The solid electrolyte

enables thinner, flatter and more flexible and robust batteries. Among other applications, the silk battery is ideal for temporary medical implants because it can be made into thin films, is biocompatible and is designed to harmlessly dissolve in the body in a few weeks, once its work has been done.

Chinese media *Polymer Science Frontier* listed this research on biodegradable batteries as one of the 31 most important outcomes in Chemistry and Materials for the first half of 2017.

THERMOCELLS

Stories of Australian Science highlighted ACES research on thermocell use in wearable technology in their recent article 'Converting body heat into useable electricity'. <http://stories.scienceinpublic.com.au/2017/thermocell-renewable-energy/>

The research led by CI Pringle from ACES Deakin talks how thermocells offer the possibility for continuous power production - ideal for use in remote locations, or to power wearable devices and even as a renewable energy option, recycling heat normally wasted from sources like power stations and car exhausts.

WEARABLES

ACES CI Prof Jun Chen is developing wearable thermocells capable of

harvesting body heat to power wearable smart electronics. ACES researchers at UOW and Deakin University nodes have recently developed gel-based electrolytes and are investigating ways of connecting thermocells – using 3D printing – to produce fabrics capable of powering electronic devices. The gel-based electrolytes could open up a variety of possibilities, including fabrics from yarns coated in the substance.

This research was covered extensively in the media after Prof Chen presented this work at UOW's 2017 Big Ideas Festival –being covered by *The Sydney Morning Herald*, *National Nine News*, *The Canberra Times*, *ABC Radio National*, *UOW's The Stand* and various local Wollongong media.

ETHICS

ACES Ethics, Engagement and Public Policy theme representatives regularly provided comment on the impact new energy and health innovations can have on individuals and society.

ACES CI Prof Rob Sparrow from Monash University has contributed to a number of broad conversations about the ethics of robotics, driverless cars, defence, sex robots and bionic body parts. He has been interviewed on *ABC TV's Lateline*, *ABC National News*, *Omny FM radio*, *Triple J's "The Hook Up"*, *Radio Talking Lifestyle*, *ABC Radio National* and for *Springer Professional* and *The Sydney Morning Herald*.

Interviews with ACES CI Prof Linda Hancock, from Deakin University, were featured on *ABC 4 Corners* and *ABC Radio National*.

ACES AI and ARC DECRA Fellow Dr Frederic Gilbert continued to share his expertise on the ethical questions related to medical bionics in a special feature of the podcasts on *Philosophical Disquisition* and *Think: Digital Futures* as well as on radio programs, including *Campus Reviews Radio Australia* and in print for the *The Sydney Herald Morning* and *The Mercury Tasmania*.

MEMBERS ACHIEVEMENTS

ACES Director Prof Gordon Wallace received a number of accolades in 2017. Gordon was appointed as an Officer in the General Division of the Order of Australia (AO) for his commitment to research collaboration and innovation and named NSW Scientist of the Year for his contribution to science.

In accepting the awards, Prof Wallace acknowledged that he was honoured to receive the awards on behalf of the many people he had been privileged to work with who are the backbone of the pioneering work.

"It's heartening to see that contributions to science and engineering are valued by the community we work for. I am so proud that the culture within ACES is such that we are driven to see fundamental discoveries and innovations through to benefit Australians." Prof Wallace's AO award was covered by the *Sydney Morning Herald*, the *Illawarra Mercury* and online science sites including The Australian Academy of Science.

In October when Prof Wallace was named NSW Scientist of the Year, this attracted media coverage across the country, including *The Australian*, the *Illawarra Mercury*, the *Canberra Times*, regional publications and features on the UOW website and research magazine as well as scientific publications including *The Australian Academy of Technology and Engineering*, *Inspiring Australia*, *Chemistry in Australia*, *SCIMAX* and *3Ders.org*. He gave interviews on *ABC Radio National – Science Show* and *ABC Radio's Counterpoint* program. *ABC NewsRadio's* Mandy Presland spoke to Prof Wallace about his vision for the future and congratulated him on being recognised for his work.

See Prof Wallace's Award acceptance speech <https://inspiringnsw.org.au/2017/10/27/2948/>

2017 NSW Scientist of the Year Gordon Wallace talks about his research journey <https://youtu.be/NAgvrAPJ->

nk@uowresearch@ARC_ACES

Prof Wallace's was the 2017 Illawarra Australia Day Ambassador making headlines with coverage of his vision for the city as a hub for future jobs in science and engineering appearing in the *Illawarra Mercury* and on *WIN News*.

Master of Philosophy in BioFabrication student Joanne Williams featured on the front page of the *Illawarra Mercury* after being awarded the 2017 Bill Wheeler Student Prize to assist her research into investigating ways to embed the anti-inflammatory drugs into the cochlear silicone implant utilising 3D fabrication techniques to produce a suitable implant-shaped structure.

Just as important is her story on her pathway into the newly formed course via her interactions with Prof Graeme Clark through her deaf son Felix (see story in Research Training chapter).

Many other ACES members were recognised for their research efforts - see AWARDS chapter following this one.

ACES COMMUNICATION PLATFORMS

THE ACES WEBSITE - ELECTROMATERIALS.EDU.AU

The ACES website has many functions.

SHOWCASES ACES RESEARCH FOR OUR STAKEHOLDERS

The research ACES does is interesting!

As mentioned above our ACES research attracts international headlines on occasions but not all ACES stories can be covered by media outlets so the ACES website provides another forum for us to showcase our work.

An added advantage to showcasing ACES research in publications or through events is that our ACES members learn the skill of putting their research findings in plain English and in context for our community.

Read our stories on electromaterials.

edu.au – a summary of those blogs are provided in Table 6.

IS THERE TO ATTRACT OUR NEXT GENERATION RESEARCHER LEADERS

ACES can't achieve high quality research outputs without attracting and inspiring high quality students to work with us. To showcase our talented members and also to assist us attracting future research leaders to ACES our website highlights events, opinions and information on what is on offer should you join the team (Table 7).

CELEBRATES ACES SUCCESSES AND SUPPORTS ACES MEMBERS

ACES is proud of their members and support them in their endeavours. Most awards would not have been possible without the ACES team inspiration, dedication and commitment to hard work. We celebrate with everyone – read the stories on our website – Table 8.

Traffic to the ACES website averaged of 2,584 sessions per month in 2017. The ACES team of researchers and students

is the most popular content on the ACES website followed by the Master Degree and PhD opportunities.

SOCIAL MEDIA

Facebook, Youtube and Twitter followings have increased above the ACES target of 10% in 2017 and have proven to be an excellent tool to engage audience-in particular, future students - with our research and to communicate opportunities to involve themselves further with ACES.

YOUTUBE

The most popular content on the ACES youtube channel continued to be dominated by artificial muscles, which is a reflection on the attention given to creating excellent video content for this particular research area. To date the video 'Fishing line artificial muscles' has been the most heavily viewed item, with 72,320 views.

Views to ACES channel: In 2017 we had 348,534 views. This represents an increase of 13% - above our KPI of 10%.

FACEBOOK

Facebook continued to be an effective platform on which to promote ACES work to an audience of primarily 25-34 year olds, mostly men (65%).

Facebook posts with a link just outperformed other types (video, photo or text), with an average reach of 603 people compared to the next best – video posts with an average reach of 593.

Likes to ACES page: 1,140 followers in 2017, compared to 1,000 followers in 2016. This represents increase of 14% and above our KPI of 10 %.

TWITTER

The ACES twitter account is used particularly for research outcome and grant/project/funding announcements.

Followers ACES twitter (ARC_ACES): In 2017 we had 697 followers up 36% from 511 in 2016 - well above our KPI of 10%. GordonWallace twitter account in 2017 had 1775 followers.

TABLE 6: SHOWCASING ACES RESEARCH ON ACES WEBSITE	WHEN
High Five for new soft robotic hand. A soft robotic hand prototype that responds to neural commands like a regular limb was today unveiled by researchers from the ARC Centre of Excellence for Electromaterials Science. Lead researcher Prof Gursel Alici said the prototype shows it is possible to create a low-cost, light, low-power prosthetic that is compatible with natural control.	9 Feb 2017
New 3D printed polymers for wound healing. 3D printing capabilities and expertise in developing hydrogels for wound healing has attracted senior researchers - Dr Xiaoju Wang and Dr Chunlin Xu from Finland on a six month exchange to ACES.	27 Feb 2017
ACES Partner Profile: Swinburne university of Technology. Professor Simon Moulton has been involved with ACES since the very beginning, first as a post-doc and more recently in the current centre, as a Chief Investigator.	23 March 2017
Professor Maria Forsyth in San Sebastian - Part 1. Associate Director of ACES, Maria Forsyth, has been in San Sebastian for the last few months, working with POLYMAT at the University of the Basque Country. This is a blog about her experience so far...	29 March 2017
Professor Maria Forsyth in San Sebastian - Part 2. Associate Director of ACES, Maria Forsyth, has been running marathons and learning Spanish while working with POLYMAT at the University of the Basque Country in San Sebastian. Prof Forsyth shares more of her experience so far...	19 April 2017
Professor Maria Forsyth in San Sebastian - Part 3. Associate Director of ACES, Maria Forsyth, has been forming some strong international connections during her time in Spain. Prof Forsyth tells us more of her work at POLYMAT in San Sebastian...	26 May 2017

TABLE 6: SHOWCASING ACES RESEARCH ON ACES WEBSITE	WHEN
Advanced medical bionics by Australia-Ireland researchers on show. Australia's Ambassador to Ireland, Mr Richard Andrews, will host a showcase of Australian-Irish research in Dublin tomorrow, highlighting the next generation of bionic devices.	24 May 2017
Handheld surgical 'biopen' repairs damaged cartilage in sheep. In a promising pilot study, researchers have shown that a handheld 3D printing pen can successfully print living cells in surgery to repair cartilage defects in sheep.	25 May 2017
Smart textiles made easier with cutting-edge materials facility. A new bioinks facility was unveiled at the ARC Centre of Excellence for Electromaterials Science (ACES) and Australian National Fabrication Facility (Materials Node) based at the University of Wollongong's Innovation Campus.	20 July 2017
ACES out and about: July-August 2017. The ACES team will be very busy in the coming weeks, presenting their ground breaking research at the 2017 RACI Centenary Congress in Melbourne, 23rd – 28th July, and the 2017 International Symposium on Energy Conversion and Storage Materials (ISECSM) in Brisbane, 31st July – 3rd August.	21 July 2017
Scientists 3D print human pluripotent cells. A breakthrough in the 3D-printing of human pluripotent stem cells means scientists are one step closer to being able to 3D print human organs and tissues for transplantation therapy.	26 July 2017
Exciting collaboration looks to the future of corneal health. ARC Centre of Excellence for Electromaterials Science (ACES), headquartered at UOW's Innovation Campus is joining forces with the <i>Lions NSW Eye Bank</i> and <i>Sydney University's Corneal Bioengineering Group</i> to implement an exciting new collaborative corneal bioengineering program.	27 July 2017
Visit to Germany strengthens alliance between ACES and Helmholtz Zentrum Berlin. A recent visit to Germany by researchers Dr Alexandr Simonov and Professor Douglas MacFarlane has strengthened the alliance between ARC Centre of Excellence for Electromaterials Science (ACES) and Helmholtz Zentrum Berlin.	18 September 2017
Prof Jari Hyttinen joins ACES for ten week sabbatical. The ARC Centre of Excellence for Electromaterials Science is delighted to have Prof Jari Hyttinen visiting us on a 10 week sabbatical from Tampere University of Technology, Finland.	13 October 2017
Funding boost for Bioprint Facility. The University of Wollongong (UOW) will establish a world first facility to enable the development of bioinks and customised bioprinting systems for targeted clinical applications. This will be greatly facilitated by the award of a \$400,000 grant from MTPConnect - the Medical Technologies and Pharmaceuticals Industry Growth Centre.	26 October 2017
Prosthetics of the future discussed at BAMN public Ethics Panel. Wollongong amputee Len Snowdon recently joined ACES Director Prof Gordon Wallace, ACES Soft Robotics for prosthetic Device Theme Leader Prof Gursel Alici and ACES Ethics, Policy and Public Engagement Theme Leader Prof Susan Dodds in a Public Ethics Panel discussion about the future of prosthetics.	1 November 2017
ARC funding for ACES projects. Chief Investigators involved in the ARC Centre of Excellence for Electromaterials Science (ACES) have welcomed more than \$4.8 million in funding for projects through the Australian Research Council (ARC) 2018 Discovery Projects and Linkage Infrastructure, Equipment and Facilities schemes.	13 November 2017
3D bioprinter designed and built by UOW's ACES team offer diabetes cure. In an Australian first, researchers from the ARC Centre of Excellence for Electromaterials Science (ACES) based at the University of Wollongong (UOW) have designed and built a customised 3D bioprinter that promises to revolutionise treatment for people with Type 1 Diabetes.	6 December 2017

TABLE 7: STORIES AIMED TO ATTRACT FUTURE STUDENTS	WHEN
Is your ACES passport stamped? Being part of ACES—or even introducing yourself to us— gives you access to an international research network that has been 30 years in the making, and can add value to your project and in the long-term, your career. Our Director Prof. Gordon Wallace calls it the “ACES passport” and he thinks every student and early career researcher in the business of translating fundamental electromaterials science research into energy and health devices should have one.	4 April 2017
Graduate Spotlight: Leo Stevens. Leo Stevens finished his PhD with ACES lead node, the Intelligent Polymer Research Institute at the University of Wollongong in 2016. He's currently working across several jobs and projects including continuing his material science research, lecturing at the University of Wollongong and sitting on the advisory board of a start-up company.	20 April 2017
Major event set to bring world experts in nanotechnology to Wollongong in 2018. A much anticipated international event is set to visit Wollongong; Australia's City of Innovation, attracting an influx of visitors along to the International Conference on Nanoscience and Nanotechnology (ICONN), at the University of Wollongong on 29th January – 2nd February 2018.	10 May 2017
ACES welcomes exchange students for BioFab research. Three students from Würzburg University in Germany will call Australia home for the next 12 months as they complete their Master of Philosophy in BioFabrication as part of a program between ACES and three leading research universities worldwide.	18 May 2017
Charles Hamilton reflects on his Harvard experience. When US born Masters student Charles Hamilton accepted an ARC Centre of Excellence for Electromaterials Science (ACES) scholarship to study at the University of Wollongong's Innovation Campus he had no idea it would lead him back to the US for a stint at Harvard University. Charles tells us about his experience.	15 August 2017
ACES welcomes six new students from Utrecht. Not long after farewelling our previous group of students from the Netherlands, the ARC Centre of Excellence for Electromaterials Science at the University of Wollongong has welcomed another six students from the University Medical Centre Utrecht and Utrecht University as part of the Global Master's degree in Biofabrication.	9 October 2017
Full circle – Jo Williams again meets the man who started her journey in biofabrication. University of Wollongong Masters of Biofabrication student Joanne Williams was Monday night's recipient of the 2017 Bill Wheeler Award. Read below to find out the inspiration that drew her to make such a life-changing decision to study with ACES.	18 October 2017
Masters of Biofab graduate finalist in international 3D printing competition. Recent graduate from the Masters degree in Biofabrication, Malachy Maher, was one of four finalists in the Millipore Sigma 2017 Life Science Awards Program in 3D printing for the work he did during his time with Utrecht University (The Netherlands), at the University Medical Center (UMC).	10 November 2017
Congratulations to our recent graduates. Students affiliated with the ARC Centre of Excellence for Electromaterials Science (ACES) graduated with PhD's recently after years of research and hard work.	15 November 2017
Maximising end user engagement with the Certificate of Entrepreneurship and Innovation. The next generation of researchers, are just beginning their scientific journeys at the ARC Centre of Excellence for Electromaterials Science (ACES) and will achieve more in the next five years than our we have in the last thirty.	11 December 2017
ENT surgeon joins ACES team in Bioprinting Massive Open Online Course (MOOC). The University of Wollongong's Bioprinting MOOC is now in its 7th run and we are pleased that over 30,000 people have participated and learnt more about the revolution in medicine that 3D bioprinting is making possible.	14 December 2017

TABLE 8: ACES CELEBRATES AND SUPPORTS OUR MEMBER'S ENDEAVOURS	WHEN
Australia Day honours for our director Gordon Wallace Australian Laureate Fellow, Distinguished Professor Gordon Wallace, has been appointed an Officer in the General Division of the Order of Australia (AO) for his commitment to research collaboration and innovation.	26 January 2017
ACES researcher awarded prestigious Fellowship in Japan ACES Early Career Researcher Dr Binbin Zhang has been awarded a prestigious Fellowship with the Japan Society for the Promotion of Science. The Fellowship will enable Dr Zhang to work in Japan for two years with Professor Junji Fukuda at Yokohama National University.	9 March 2017
Professor Michelle Coote awarded Georgina Sweet Australian Laureate Fellowship Congratulations to ACES Chief Investigator, Prof Michelle Coote, who has been awarded the Georgina Sweet Australian Laureate Fellowship by the Australian Research Council.	7 June 2017
ACES International Advisory Committee member elected into prestigious Academy Fellowship International Advisory Committee member for the ARC Centre of Excellence for Electromaterials Science, Dr Anita Hill, has been elected into the Australian Academy of Science's prestigious Fellowship.	15 June 2017
The team behind the Biopen named as finalists in Australian Museum Eureka Prizes The team behind the Biopen, made up of researchers from the ARC Centre of Excellence for Electromaterials Science (ACES) at the University of Wollongong, St Vincent's Hospital Melbourne and the University of Melbourne Department of Surgery have been named as finalists for the prestigious UNSW Eureka Prize for Excellence in Interdisciplinary Scientific Research for their cutting-edge handheld 3D printing device.	28 July 2017
ACES collaborator Prof Gerard Sutton wins 'Big Idea' ACES collaborator Prof Gerard Sutton from the Save Sight Institute was the winner of the inaugural 'Big Idea' research funding challenge recently hosted by Sydney Research. The event kicked off Sydney Local Health District's 2017 Innovation and Research Symposium.	31 July 2017
Prof Gordon Wallace named 2017 NSW Scientist of the Year. Professor Gordon Wallace, Director of the ARC Centre of Excellence for Electromaterials Science (ACES) at the University of Wollongong (UOW), has been named 2017 NSW Scientist of the Year.	23 October 2017
ACES Associate Director Professor Maria Forsyth wins Victoria Prize for Science and Innovation. ARC Centre of Excellence for Electromaterials Science (ACES) Associate Director and Deakin University Professor Maria Forsyth named winner of the 2017 Victoria Prize for Science and Innovation.	27 October 2017
NSW Scientist of the Year talks to ABCRadio about his vision for the future. As Executive Director of the ARC Centre of Excellence for Electromaterials Science (ACES) at the University of Wollongong (UOW) and the Australian National Fabrication Facility (ANFF) - Materials node, Professor Wallace has led the development of innovative approaches to materials processing and fabrication tools that enable advanced materials to be integrated into practical devices for use in energy and medical bionics. ABC NewsRadio's Mandy Presland spoke to Professor Wallace about his work.	31 October 2017
Synthetic Energy Systems Theme leader wins prestigious Australian Academy of Science award. Congratulations to ARC Centre of Excellence for Electromaterials Science (ACES) Chief Investigator, Synthetic Energy Systems Theme leader and Communications Director, Professor Doug MacFarlane who has been awarded the Australian Academy of Science 2018 David Craig Medal.	17 November 2017

PUBLIC ENGAGEMENT

ACES researchers took part in a number of public lectures, media interviews and public engagement events, in which they described

fundamental scientific advances, and the implications for improving health and energy technologies. We describe below some of those activities in more detail and a list of outreach activities are listed in Table 9.

PROSTHETICS OF THE FUTURE DISCUSSED AT BAMN PUBLIC ETHICS PANEL

Wollongong amputee Len Snowden joined ACES Director Prof Gordon Wallace, ACES Soft Robotics for prosthetic Device Theme Leader Prof

Gursel Alici and ACES Ethics, Policy and Public Engagement Theme Leader Prof Susan Dodds in a Public Ethics Panel discussion about the future of prosthetics in September 2017.

The Public Ethics Panel titled 'Prosthetics of the Future' was held as part of the three-day Biominetics, Artificial Muscles and Nano-bio (BAMN) conference, and gave the community an opportunity to learn about the latest ACES prosthetics research.

The ACES team is building a multi-digit 3D robotic prosthetic hand that is easy to control, lightweight, flexible, low-cost, and give users sensory feedback. People, like Len, who use prosthetics are an integral part of the design process as the aim of the research is to help people to restore normality.

ACES researchers have been conducting a survey asking people with an upper limb loss what they want in a prosthetic hand. Preliminary survey results had shown that high functionality, affordability and appearance were the respondents' top criteria in choosing prosthetics, and that comfort level, durability and weight of the prosthetic, were the most important design considerations for participants. In terms of appearance, 50 % of participants said they would prefer a prosthetic to look lifelike.

CI Susan Dodds was also a panelist at the UNSW Social Policy Debate addressing the topic 'the creativity of disability' at the Sydney Masonic Centre, 23 February 2017.

CI Robert Sparrow was a panelist for the topic 'Frankenstein anxiety' at the World Science Festival held in Brisbane, 23 March 2017.

THE AUSTRALIAN ACADEMY OF SCIENCE PLASTIC FANTASTIC NATIONAL SPEAKER SERIES

An evening of science where the speakers took the audience into the world of polymers and how they are being used in everything from cancer



treatments, to tackle antibiotic resistance and in 3D printed body parts.

ACES Director Prof Gordon Wallace was a presenter in this series of public lectures, hosted in Wollongong, Brisbane and Adelaide with the generous support of Academy Fellow and developer of the polymer banknote, Prof David Solomon AC FAA. Damaged cartilage, shape-shifting medical implants and anti-cancer drugs delivered using nanoparticles is not the stuff of fantasy. This is the now.

'BIG IDEAS' FESTIVAL AT UNIVERSITY OF WOLLONGONG

The UOW Big Ideas Festival, a showcase of the University's ground-breaking research, was attended by upto 500 members of the community. ACES CI Prof Jun Chen wowed the audience and media alike with his 'Wearable tech. Powered by Happiness' talk.

Prof Chen collaborates with an international team of researchers as a CI of ACES, as well as the University of Texas Dallas and King's College London to refine ways of harvesting and making use of a constant and natural power source – body heat.

Human beings lose heat. A resting male can put out between 100 and 120 watts of energy a day, in theory enough to power many popular electronics, like a Nintendo Wii (14 watts), mobile phone (about 1 watt) or a laptop (45 watts).

The major challenge for Jun's team is to create a current (hence power) from a material that is not rigid and can bend to the contours of the body. Jun received an ARC Discovery Project Grant in collaboration with Dr Leigh Aldous, of King's College London to progress the research.

The event also hosted interactive research stands (ACES had two stands) and fantastic entertainers.

UOW's 'The Stand' had a chat with Prof Jun Chen on his work with thermocells and wearable technology. <http://stand.uow.edu.au/wearable-tech-powered-by-happiness/>

Prof Gordon Wallace and A/Prof Jeremy Crook also had a chat to 'The Stand' on 3D printing: from science fiction to science fact. <http://stand.uow.edu.au/3d-printing-from-science-fiction-to-science-fact/>

TABLE 9: ACES OUTREACH ACTIVITIES IN 2017		WHEN	WHERE
1.	STEM Camp for Year 10 Girls: ACES UOW held laboratory tours with demonstrations of the research for participants. More than 80 young women, from high schools across New South Wales and the ACT, attended the STEM (Science, Technology, Engineering and Maths) camp to inspire them to change the world through engineering and technology-related areas (10-15 January).	15 January	iC campus UOW Wollongong
2.	LKM Public Address: This is a free, public event to celebrate the life of one of Australia's great scientific minds. Leon Kane-Maguire was one of Australia's leading scientists, based at the University of Wollongong. Leon's pioneering research in nanomaterials was balanced by his down-to-earth attitude and a wicked sense of humour. In 2017 the audience was addressed by John Madden, Professor of Electrical and Computer Engineering at the University of British Columbia, Canada. Prof Madden began his research career working on artificial muscle and the creation of microstructures by direct write electrodeposition. He has also been investigating the use of emerging materials in supercapacitors, batteries, organic electronics and stretchable touch interfaces.	8 February	iC campus UOW Wollongong
3.	Public Lecture to ANU Springbank Circle (Community members who have donated to ANU) by Prof Michelle Coote on 'Computer-aided Chemical Design'	6 April	ANU, Canberra
4.	Corneal Bioengineering Launch: to celebrate the new initiative with the Lions NSW Eye Bank and Sydney University's Corneal Bioengineering Group who together with ACES are implementing an exciting new collaborative corneal bioengineering program.	27 July	iCampus UOW Wollongong
5.	University of Tasmania Open Day: ACES UTAS ran a 3D printing demonstration and microfluidics display for this event.	30 July	Chemistry, University of Tasmania
6.	Open to the Public: ACES UOM at St Vincent's Hospital Melbourne opened their doors to approximately 60 members of the public for Convergence Science Network.	9 August	St Vincent's Hospital Melbourne
7.	Australian Academy of Science - 'Making Better Humans' Speaker Series PART 1 ACES Director Gordon Wallace was invited to speak along with four other scientists as part of the Academy of Science 'Making Better Humans' speaker series which delved into the world of polymers and how they are being used to make better humans. Prof Wallace spoke about how 3D printing has changes the way we think about making things as well as the materials and components that can be used like biopolymer structures using living stem cells. ACES staff also ran 3D bioprinting demonstrations at this event which was held during National Science Week.	17 August	iC campus UOW Wollongong
8.	ACES / IPRI opens its doors to the public as part of National Science Week. 48 community members - including two high school students were taken on tours of ACES at UOW research facilities and given an overview of the research work being undertaken.	17 August	iC campus UOW Wollongong
9.	UOW Postgraduate Information Week: Targeted information flyers prepared and displayed at UOW Postgraduate Information Week aimed at attracting prospective students to inquire about ACES research opportunities.	4 - 8 September	UOW main campus Wollongong
10.	Public Lecture by Prof Michelle Coote on 'Computer-aided Chemical Design- The Future of Chemistry?'	12 Septmber	UTAS

TABLE 9: ACES OUTREACH ACTIVITIES IN 2017		WHEN	WHERE
11.	ACES /IPRI Student Open Day: An open invitation for prospective students to come and tour the labs, view our facilities and talk to our staff, potential supervisors and current PhD and Masters students about research opportunities over a BBQ lunch.	13 September	iC campus UOW Wollongong
12.	BAMN Public Ethics Community Panel: Amputee Len Snowden joined ACES Director Prof Gordon Wallace, ACES Soft Robotics for prosthetic Device Theme Leader Prof Gursel Alici and ACES Ethics, Policy and Public Engagement Theme Leader Prof Susan Dodds in a Public Ethics Panel discussion about the future of prosthetics. 98 people registered to attend this event which was open to community.	25 September	iC campus UOW Wollongong
13.	UOW Big Ideas Festival: ACES UOW CI Prof Jun Chen spoke at UOW's Big Ideas Festival – a TED X style event with 12 speakers that was open to member of the public. His talk on 'Wearable Technology: Turning body heat into electricity' proved very popular. ACES staff were involved in the exhibition accompanying the event providing demonstrations and answering questions about 3D printing.	4 October	UOW Wollongong main campus
14.	Australian Academy of Science-'Making Better Humans' Speaker Series: PART II ACES Director Gordon Wallace was invited to speak along with four other scientists as part of the Academy of Science 'Making Better Humans' speaker series which delved into the world of polymers and how they are being used to make better humans.	5 October	Queensland Museum, Brisbane Queensland
15.	Bill Wheeler Symposium and Student Award- Community Event: The prize is awarded at the Bill Wheeler Community Symposium, which also features presentations on cutting-edge bionics research. This year's guest speaker was Prof Graeme Clark, the brilliant brain behind the Bionic Ear. Prof Clark's inspirational device has provided the gift of speech understanding to 450,000 profoundly deaf people across the world. The winner of the 2017 student prize was ACES researcher Jo Williams who attended the Bill Wheeler Symposium with her eight-year-old son Felix who was born deaf and received the multi-channel Cochlear Implant developed by Prof Clark when he was five months old. Ms Williams' research at ACES involves developing 3D printed dual drug delivery components which she hopes could be used in cochlear devices in the future.	16 October	iC campus UOW Wollongong
16.	Additive Fabrication presentation to Kiama University of the Third Age (U3A): ACES Additive Fabrication Technician Adam Taylor was invited to speak at Kiama U3A's monthly meeting about his work with ACES. Adam's presentation titled 'From mass customisation to tailor-made biomedical devices – the applications and evolution of Additive Fabrication' was enthusiastically received by the group of about 50 people with loads of questions.	23 October	Kiama Neighbourhood Centre, Kiama
17.	ACES Exhibition Booth at Graeme Clark Oration Biomedical Innovation Showcase: ACES RF Justin Bourke hosted the ACES demonstration booth to showcase the research activities being undertaken in ACES.	30 October	Melbourne Convention Centre
18.	Australian Academy of Science – 'Making Better Humans' Speaker Series PART III ACES Director Gordon Wallace was invited to speak along with four other scientists as part of the Academy of Science 'Making Better Humans' speaker series which delved into the world of polymers and how they are being used to make better humans.	2 November	The Science Exchange Adelaide South Australia



ACES were honoured to host Prof Graeme Clark as guest speaker for the 2017 Bill Wheeler Symposium. Pictured here with Mrs Lexie Wheeler, Joanne Williams and Gordon Wallace.

INSPIRING THE NEXT GENERATION OF SCIENTISTS AND THEIR TEACHERS

'OUT OF HAND' POWERHOUSE MUSEUM

ACES had the 'biopen' featuring in a display 'out of hand - materialise the digital' a year long exhibition at the Powerhouse museum in Sydney, 2016-17. The exhibition also showcased metal 3D printed jewellery ACES-ANFF members at UOW produced in collaboration with metal smith jeweller Cinnamon Lee. Out of Hand's total visitation was 97,964.

ACES NANO-EXHIBIT AT THE WOLLONGONG SCIENCE CENTRE

Four display items from the original ACES nano-exhibition are still on display at the Wollongong Science Centre. That exhibit has been seen by 15,560 school children, 32,380 members of the public and 2,389 groups in 2017.

RECONCEPTUALISING MATHS AND SCIENCE TEACHER EDUCATION PROGRAMS (REMSTEP)

Following on from the successful Reconceptualising Maths and Science Teacher Education Program (ReMSTEP) that concluded at the end of 2016, Deakin University held another pre-service

teacher education activity in 2017.

ACES ECR, Madeleine Dupont met with trainee teachers to explain the research into thermal energy harvesting and help them develop an experiment related to the research but suitable for high school students. The trainee teachers worked alongside ACES members in the Deakin labs, recording a short video of Madeleine giving an overview of her work and demonstrating the experiment involving a basic Seebach coefficient measurement.

RESEARCH EXPERIENCE FOR TEACHERS (RET) PROGRAM

ACES AI Frederic Gilbert ran the Research Experience for Teachers (RET) program in relation to neuroethics at the University of Washington, 25 July. Middle and high school teachers were shown how to integrate neuroethics themes into the design of their science teaching curriculum units.

ACES AI Frederic Gilbert was interviewed for a video by Eatonville Middle School (Seattle, US) for an educational unit about the ethics of Brain- Computer Spinal Cord Interfaces.

Frederic was also approached by the Science Teacher & Grade Advisor from Seattle Girls' School (Seattle, USA) about integrating a neuroethics unit within curriculum science classes design.

STUDENT INTERACTIONS

BRAINSTEM INNOVATION CHALLENGE

The BrainSTEM innovation challenge offers high school students the opportunity to work in a research environment and participate in the journey of scientific discovery side by side with their STEM mentor. Over the last 3 years ACES CI Simon Moulton has been a STEM mentor to four Melbourne based high school student groups (years 9 and 10).

The groups visit Swinburne University of Technology for one hour each week for 8 weeks, where Simon mentors them in their task to produce a STEM based concept/idea/product. At the end of 8 weeks the students present to the whole BrainSTEM participants <http://brainstem.org.au/index.html>. ACES PhD students Shaun and Lilith were co-mentors along with Simon for two of the schools.

SUMMIT AIMS TO INSPIRE GIRLS TO BECOME ENGINEERS

More than 80 young women, from high schools across New South Wales and the ACT, attended the STEM (Science, Technology, Engineering and Maths) camp at UOW to inspire them to change the world through engineering and technology-related areas (10-15 January). ACES UOW held laboratory tours with demonstrations of our research for participants as part of this event on 15 January.

ACES AT AUSTRALIAN MUSEUM SCIENCE FESTIVAL

Adam Taylor our ACES additive fabrication technician spent the day at the Australian Museum Science Festival, held in Sydney on 17 August. Adam was showcasing 3D printing, science and technology to high school students with the aim to encourage and inspire future generations to consider studying STEM careers.

INSPIRING INDIGENOUS STUDENTS

ACES UOW PhD student Bijan Shekibi, working at St Vincent's hospital

Melbourne, visited Residential Indigenous Science Experience (RISE) students to show Indigenous high school students some of the research that is done in the 3DBIOFab Centre, 28 November 2017.

SCIENCE SHOW

ACES RF Alexandr Simonov from Monash University assisted with a physics-chemistry science show at Valkstone Primary School, Melbourne.

GUNDAROO PRIMARY SCHOOL

Prof Michelle Coote completed a series of guided (but hands on) chemistry experiments including nylon synthesis and slime making (via cross-linking of PVA with borax), and some additional demonstrations (including sugar and sulfuric acid) with class 2/3 at Gundaroo School, 21 February 2017.

HOSTING STUDENTS AT ACES NODES

ACES at Deakin University hosted the Year 12 Ashwood High School Chemistry class, 25 May 2017. The class completed a laboratory practical

on electrodeposition of metals and a theory session designed to support their curriculum work.

ACES at UTAS conducted a one hour laboratory tour for 12 students from Calvin Christian School, Hobart, Tasmania. They demonstrated the new research in analytical chemistry and electromaterial areas that are being pursued in ACROSS and ACES, 2 August 2017.

ACES UOW CI Prof Marc in het Panhuis hosted 30 Dapto High School students at ACES UOW, 22 November. The students and science teacher toured the ACES labs and viewed several demonstrations of research being undertaken; including the popular 3D printing.

OUTREACH AND ENGAGEMENT

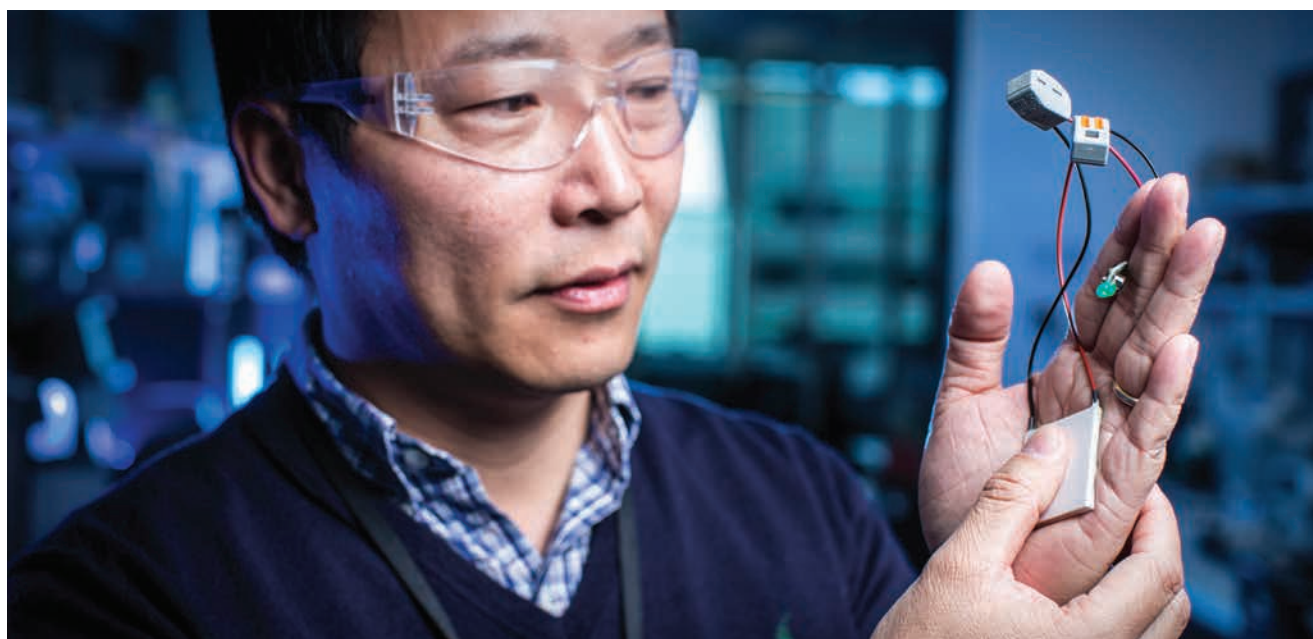
Linda Hancock and Natalie Ralph from the ACES EPPE team are drivers within the newly established Deakin University Science and Society Network, a cross-University team promoting Science and Technology Studies and knowledge, through innovative research addressing national and global issues, and industry engagement. In February, the team was

successful in the initial round for the competitive Deakin University Cross Collaboration Fund scheme and held 2 events in 2017 – 21 March and 1 May.

Natalie Ralph participated in the (online) conference call of the United Nations Global Compact & PRME (Principles for Responsible Management Education) Working Group on Business for Peace, attended by 18 academics/consultants, USA, 4 May.

Justin Bourke, ACES RF from University of Melbourne, is a member of the executive committee for Women in STEM Australia from February 2017.

Justin attended the International Women's Day (IWD2017) Australian Institute of Management Great Debate, held in Melbourne, 8 March. The topic, 'Australia in 2017 is still a man's world' had debaters addressing the current state of gender equality in Australia and whether women have really achieved social and economic equality. The event celebrates the importance of gender diversity in Australian society, specifically in the Australian workplace, highlighting that Diversity Matters.



ACES CI Prof Jun Chen collaborates with an international team of researchers to refine ways of harvesting and making use of a constant and natural power source – body heat.

Awards

NSW AND VICTORIA SCIENCE AWARDS FOR ACES DIRECTOR AND ASSOCIATE DIRECTOR

Our ACES director and associate director were named 2017's NSW Scientist of the Year and winner of the Victoria Prize for Science and Innovation-Physical Sciences respectively.

VICTORIA PRIZE FOR SCIENCE AND INNOVATION- PHYSICAL SCIENCES

The Victoria Prize for Science and Innovation, announced 26 October 2017, was awarded to Prof Maria Forsyth. The \$50,000 prize celebrates leadership, determination and creativity and is awarded to outstanding science leaders. It also highlights the many ways in which research and development of international significance are



conducted in Victoria. Maria, from the ACES node at Deakin University, leads the research effort in metal-air batteries and the development and understanding of new electrolyte systems. A key area of interest in Prof Forsyth's research is selective transport in materials for energy storage applications. Her work has focused on understanding the phenomenon of charge transport at metal/electrolyte interfaces and within novel electrolyte materials such as novel ionic liquids, polymer electrolytes and plastic crystals.

Prof Forsyth said winning the Victoria Prize for Science and Innovation in the 20th year of the prize is an "amazing honour".

"I'm very proud of my team and grateful for the wonderful group of scientists I collaborate with, both locally and internationally. It's through research collaboration and teamwork that we make real scientific and technological breakthroughs. ACES has provided a great supportive, collaborative and stimulating environment for such a long time. I feel proud and privileged to be part of it."

Her work has led to many other awards including the Corrosion Medal (2013), Eureka Prize Finalist (2013), and election to the Australian Academy of Science (2015). In 2016 she was awarded the Galileo Galilei Award at the International Symposium on Polymer Electrolytes and in 2017 was inducted as a Fellow of the International Society of Electrochemistry (ISE).

NSW SCIENTIST OF THE YEAR

Prof Gordon Wallace was named the 2017 NSW Scientist of the Year, 23 October.

From intelligent polymers, bioinks

and 3D printed implantable medical devices, to energy conversion and the formation of hydrogen from water in to fuels - Gordon Wallace is recognised for his work on some of the world's most inspiring research projects.

As Executive Director of ACES at the University of Wollongong (UOW) and the Australian National Fabrication Facility (ANFF) - Materials node, Gordon has led the development of innovative approaches to materials processing and fabrication tools that enable advanced materials to be integrated into practical devices for use in energy and medical bionics.

Gordon was among ten leading researchers, innovators and educators who were honoured at the 2017 Premier's Prizes for Science & Engineering.

NSW Premier Gladys Berejiklian said the Prizes recognise the contribution scientists and engineers made to our everyday lives.

"This year's Prizes again demonstrate NSW has some of the world's best and brightest scientists and technologists across a diverse range of disciplines right here in our own backyard.

Through their inspiring ingenuity and innovation this year's winners have delivered economic, environmental, health, social and technological benefits for the global community," Ms Berejiklian said.

Prof Wallace paid tribute for the work to his team.

"It is a great honour to have a fantastic team to captain and for our research to be recognised in this way. We will continue to strive to ensure that our most fundamental discoveries are translated into real applications to the benefit of our communities in the most effective way possible."



PROF DOUGLAS MACFARLANE AWARDED DAVID CRAIG MEDAL AND LECTURE FOR 2018

Congratulations to ACES Chief Investigator, Synthetic Energy Systems theme leader and Communications Director, Prof Doug MacFarlane who has been awarded the Australian Academy of Science 2018 David Craig Medal.

The David Craig Medal and Lecture is made in honour of the outstanding contribution to chemical research of the late Emeritus Prof David Craig, AO, FAA, FRS. The purpose of the award is to recognise contributions of a high order to any branch of chemistry by active researchers.

Prof Doug MacFarlane's research at Monash University and through ACES has focused on the discovery and development of novel liquid salt compounds that offer unique properties as media and solvents for a wide range of applications. Research into these 'ionic liquids' has experienced major expansion over the last 25 years. The discoveries of Prof MacFarlane's team have contributed to the study and use of ionic liquids, helping to establish the area as a major field of chemistry.

The team has explored application of ionic liquids in sustainable energy technologies, producing major advances in energy storage in advanced batteries,

as chemical energy storage as hydrogen and ammonia, and as thermal energy storage materials for domestic use.

The intellectual property arising from some of these developments has been spun out into several start-up companies. The team has also pioneered the use of biocompatible families of these liquid salts as media for therapeutic proteins and as novel pharmaceuticals. These developments have opened up new treatment modalities, including as a topical treatment for skin cancer.

"It represents the recognition of career-long contributions from our group in breaking new ground in chemical systems based on ionic liquids. It is also recognition the fine contributions made by the many students, postdoctoral fellows and collaborators who have worked with our group over many years, generating fascinating and wonderful new science," stated Prof MacFarlane.

Australian Academy of Science President Prof Andrew Holmes congratulated Prof MacFarlane on his inspiring research.

"Research by this year's awardees is addressing some of society's biggest challenges and also changing the world for the better. It is absolutely crucial that we continue to recognise and support their outstanding contributions so that people continue to be reminded of the important role of science for humankind," Prof Holmes said.

Success in exploring the uncharted territories of science, recognised by this award, must surely represent an excellent example of cutting-edge research originating from within Australia and being well-supported by various agencies.

"It is important in that regard for me to acknowledge the strong support of our work by the ARC through various fellowships, discovery and linkage program grants and, of course, through the Australian Centre of Excellence for Electromaterials Science." Doug MacFarlane

PROFESSOR MICHELLE COOTE AWARDED GEORGINA SWEET AUSTRALIAN LAUREATE FELLOWSHIP

Congratulations to ACES Chief Investigator, Prof Michelle Coote, who has been awarded the Georgina Sweet Australian Laureate Fellowship by the Australian Research Council.

Based at the Australian National University (ANU) in Canberra, Prof Coote leads the modelling team at ACES.

Prof Coote and her team have led the way in the development and application of accurate computational chemistry for modelling radical polymerisation processes, working with experimental collaborators to put their computational designs into action.

The funding received as a result of this fellowship will aid in the development of catalysts that are able to accelerate and control the chemical reactions used in the synthesis of pharmaceuticals and materials, with significant practical benefits to industry. It will also be used to train the next generation of chemists in the principles of computer-aided chemical design.

Prof Coote became the first female professor of chemistry at ANU in 2011 and was elected a Fellow of Australian Academy of Science in 2014. She is also chair of the polymer division of the Royal Australian



Chemical Institute (RACI) and the first Australian Associate Editor of the Journal of the American Chemical Society.

Her other achievements include the IUPAC prize for young scientists (2001), the RACI Cornforth medal (2000), Rennie medal (2006) and David Sangster Polymer Science and Technology Achievement Award (2010), the Academy's Le Fevre Memorial Prize (2010), HG Smith Medal (2016) and the Pople Medal of the Asia-Pacific Society of Theoretical and Computational Chemistry (2015).

ACES CI MARK COOK ELECTED FELLOW IN THE AUSTRALIAN ACADEMY OF HEALTH AND MEDICAL SCIENCES.

Society Fellowship is an honor bestowed on the best of our profession by election in recognition of their outstanding leadership and distinguished contributions to the field.

ACES CI Prof Mark Cook, from the University of Melbourne and St Vincents Hospital Melbourne, represents professionals who work in high quality research and clinical practice and demonstrate leadership.

"It matters to the community to offer



solutions and we are working to provide solutions every day."

Mark specialises in neuroscience and leads the fundamental research within the ACES Synthetic Biosystems theme.

Researchers are always developing new and improved devices. Prof Cook (now also head of the Graeme Clark Institute) is leading a team developing an implant to sit under the scalp to better diagnose and optimise treatment for epilepsy, which is even capable of reliably forecasting the likelihood of seizures. He is also conducting a study of implantable drug pumps for patients with drug-resistant epilepsy at St Vincent's Hospital Melbourne.

AUSTRALIA DAY HONOURS FOR OUR ACES DIRECTOR PROFESSOR GORDON WALLACE

Australian Laureate Fellow, UOW Distinguished Professor Gordon Wallace, was appointed an Officer in the General Division of the Order of Australia (AO) for his commitment to research collaboration and innovation in January 2017.

Established in 1975, the Australian Honours List recognises men and women for outstanding contributions that have made a significant difference to Australian life and to humanity at large.

The award recognises Gordon's distinguished contribution to nanobionics research, his commitment to research collaboration and innovation, and the subsequent economic, educational, technological and health benefits on a national and international scale that have been generated by his research activities.

"I am honoured to receive this award on behalf of the many people I have been privileged enough to work with. It's heartening to see that contributions to science and engineering are valued by the community we work for.

I am so proud that the culture at ACES and IPRI is such that we are driven to see

fundamental discoveries and innovations through to benefit Australians."

FELLOW OF THE ROYAL SOCIETY OF CHEMISTRY

CI Jennifer Pringle, ACES Deakin University, was accepted as a Fellow of the Royal Society of Chemistry in November 2017. A Fellow of the Royal Society of Chemistry is recognition of more than five years in a senior position, where the researcher's efforts have made an impact in a field of the chemical sciences.

THE TEAM BEHIND THE BIOPEN NAMED AS FINALISTS IN AUSTRALIAN MUSEUM EUREKA PRIZES

The team behind the Biopen (a cutting-edge handheld 3D printing device) made up of researchers from ACES at the University of Wollongong, St Vincent's Hospital Melbourne and collaborators from the University Of Melbourne Department of Surgery were named as finalists for the prestigious UNSW Eureka Prize for Excellence in Interdisciplinary Scientific Research in 2017. The UNSW Eureka Prize for Excellence in Interdisciplinary Scientific Research is presented to an individual or team who has produced a groundbreaking research outcome that was only possible as a result of the integration of two or more unrelated disciplines.

The 'BioPen' collaboration draws upon the diverse skills of materials scientists, cell biologists, mechatronic engineers and clinicians to develop a handheld 3D printer, 'the Biopen', which can be used in surgery to repair damaged cartilage.

The nominated team is led by ACES Director Prof Gordon Wallace and Director of Orthopaedics and Professor of Surgery at St Vincent's Melbourne Hospital, Prof Peter Choong. Other members of the team are Dr Claudia Di Bella, Dr Stephen Beirne, Dr Cathal O'Connell and Dr Zhilian Yue.

The multidisciplinary team will continue to develop the device through



Prof Gordon Wallace AO awarded the 2017 NSW Premier's Prizes for Science and Engineering

the convergence of their skills and experience - all with a common vision to produce a clinical solution to a big problem - cartilage regeneration.

2017 UOW VICE CHANCELLOR'S INTERDISCIPLINARY RESEARCH EXCELLENCE AWARD

The award recipients: A/ Prof Robert Gorkin, Dr Jason McArthur, A/Prof Christopher Magee, A/Prof Kate Senior, Ms Laura Grozdanovski and ACES CIs Profs Geoff Spinks and Simon Moulton all worked on the Geldom project: Designing the Next-Generation Condom. The condom is based on ACES ultra-tough hydrogel materials and has attracted Bill & Melinda Gates

Foundation Funding.

The Vice-Chancellor's Interdisciplinary Research Excellence Award recognises outstanding contributions to research by a team of UOW researchers collaborating across discipline boundaries, who have combined their expertise to produce achievements of outstanding international significance.

ENDEAVOUR FELLOWSHIP FOR ACES ASSOCIATE INVESTIGATOR

ACES AI from Deakin University Dr Haijin Zhu was awarded an Endeavour fellowship. He visited POLYMAT at the University of Basque Country in Spain, 03 June-03 October 2017, as a part of that Endeavour Fellowship.

ACES CLINICAL COLLABORATOR PROF GERARD SUTTON WINS 'BIG IDEA'

ACES clinical collaborator Prof Gerard Sutton from the Save Sight Institute was the winner of the inaugural 'Big Idea' research funding challenge hosted by Sydney Research. The event kicked off Sydney Local Health District's 2017 Innovation and Research Symposium.

The focus of Prof Sutton's 'Big Idea' was a biopen-type device - the iFixpen - that uses a customised bioink to virtually 'colour in' and correct an eye injury. The team developing the device won \$44,125 in the inaugural 'Big Idea' research funding challenge. Listen to Prof Sutton's pitch: <http://www.electromaterials.edu.au/news/aces->



collaborator-prof-gerard-sutton-wins-big-idea/

The idea is the result of collaboration between ACES, Lions NSW Eye Bank and Sydney University's Corneal Bioengineering Group to develop the 'iFixpen' for corneal regeneration after corneal ulceration. The customised 'bioink' will have the capacity to facilitate healing and prevent infection in treating the disease.

MASTERS OF BIOFAB GRADUATE FINALIST IN INTERNATIONAL 3D PRINTING COMPETITION

Recent graduate from the Masters degree in Biofabrication, Malachy Maher, was one of four finalists in the Millipore Sigma 2017 Life Science Awards Program in 3D printing for the work he did during his 10 month stay with Utrecht University (The Netherlands), at the University Medical Center (UMC).

The four finalists demonstrated their potential as future leaders in life science by highlighting that their research is capable of significantly impacting 3D printing through cutting edge innovation in applications and

printing tools. Entry was open to Masters and PhD level students located in the USA, Canada and Europe. Malachy was the only Masters level finalist - awarded \$1500 USD for reaching this stage of the competition.

On the 18th October, Malachy was given the opportunity to present his research on 'Cardiac patches to mend broken hearts' to the selection committee in Burlington, Massachusetts, USA. This work was completed in Utrecht as part of his Masters degree under the supervision of Dr Miguel Castilho, Prof Jos Malda and Prof Joost Sluijter.

The cardiac patch is a scaffold that will support and grow cells to repair heart failure in patients. A 3D printing technique called Melt Electrospinning Writing (MEW) was used to print different architectures into the scaffolds which will allow it to stretch and recover with each heartbeat. Induced pluripotent stem cell (iPSC) derived cardiomyocytes were then added to the scaffolds, which began to contract and beat like a native heart. Work will continue on this project in Utrecht.

Malachy began his Masters degree in 2015 at the University of Wollongong

working on the Biopen project for articular cartilage regeneration under the supervision of Dr Zhilian Yue, Prof Gordon Wallace and Prof Peter Choong. He completed his degree in The Netherlands as part of the joint global program between the University of Wollongong, University Medical Center Utrecht, Queensland University of Technology and University of Würzburg.

ACES PHD GRADUATE MEGA KARR AWARDED ADVANCING WOMEN'S RESEARCH SUCCESS GRANT FROM MONASH UNIVERSITY UNDER THEIR GENDER EQUITY PROGRAM

The Advancing Women's Research Success grant from Monash University was awarded to ACES PhD graduate Mega Karr in 2017. Advancing Women's Research Success Grant supports the career progression of early to mid-career high potential female academic staff with primary carer responsibilities and assists the university in fostering talent to progress women to senior roles.

Grant awardees receive funds to support a range of research activities so that they can maintain or enhance the momentum of their research productivity and strengthen their research profile.

TWO STUDENTS WIN TRAVEL SCHOLARSHIP VIDEO CHALLENGE

Two ACES students were winners in the Global Challenges 2016 Travel Scholarship Video Challenge. The challenge for students was to produce a two-minute video, outlining how their research aligns with one of UOW's Global Challenges. The program received more than 40 entries and 10 winners were selected.

Biofabrication masters student Malachy Maher and ACES PhD student Syamak Farajikhah were both selected for their videos: '3D printing cartilage for Osteoarthritis patients' and 'Textiles meet science in public health'.

The students received \$2,000 to

travel anywhere in the world in support of their research. Malachy chose to present his research at the Bioengineering 2017: BioMEMS, 3D-bioprinting, Tissue Engineering and Synthetic Biology meeting in Boston, USA in March 2017. The conference strongly aligned with his Masters in Biofabrication and specifically his work on 3D printing for tissue engineering.

Syamak chose to use his money for a research exchange to RMIT textile and fashion school in Melbourne to work on a collaborative research project then to Deakin University Geelong campus to measure thermal conductivity of his textile fibres in November 2017.

ACES INTERNATIONAL ADVISORY COMMITTEE MEMBER, DR ANITA HILL, HAS BEEN ELECTED INTO THE AUSTRALIAN ACADEMY OF SCIENCE'S PRESTIGIOUS FELLOWSHIP.

Dr Hill has held a position at CSIRO since 1996, and is aiding in building Australia's international standing in the field of nanostructured materials and processes.

Dr Hill specialises in the study of transport of atoms, ions and small molecules in condensed matter. Data collected by Dr Hill and her team at CSIRO has proved to be integral in the development of theory and design rules for membrane performance.

This Fellowship was earned as a result of her particular focus on the measurement of open volume in condensed matter.

Dr Hill currently holds the position of Executive Director of Future Industries at CSIRO which includes Manufacturing, Health and Biosecurity,

and CSIRO Services. She also serves on the advisory boards of ACES, the Australian Institute for Bioengineering and Nanotechnology, the Australian Synchrotron, Swinburne Industry Research, and Journal of Polymer Science: Polymer Physics (editorial board).

FUNDING FOR PROJECTS THROUGH THE AUSTRALIAN RESEARCH COUNCIL DISCOVERY PROJECTS SCHEME

Chief Investigators involved in ACES have welcomed more than \$4.8 million in funding for projects through the ARC 2018 Discovery Projects and Linkage Infrastructure, Equipment and Facilities schemes.

Among the successful Discovery Projects due to commence in 2018, was a project 'Ultra-low Fouling Active Surfaces' involving Swinburne University node ACES CI Prof Simon Moulton and University of Wollongong node CI Robert Kapsa and ACES RF Dr Anita Quigley.

A further \$3.8 million was awarded for infrastructure projects through the Linkage, Infrastructure, Equipment, and Facilities (LIEF) scheme for funding commencing in 2017. This scheme allows collaboration between universities and partner organisations to develop and support expensive research infrastructure.

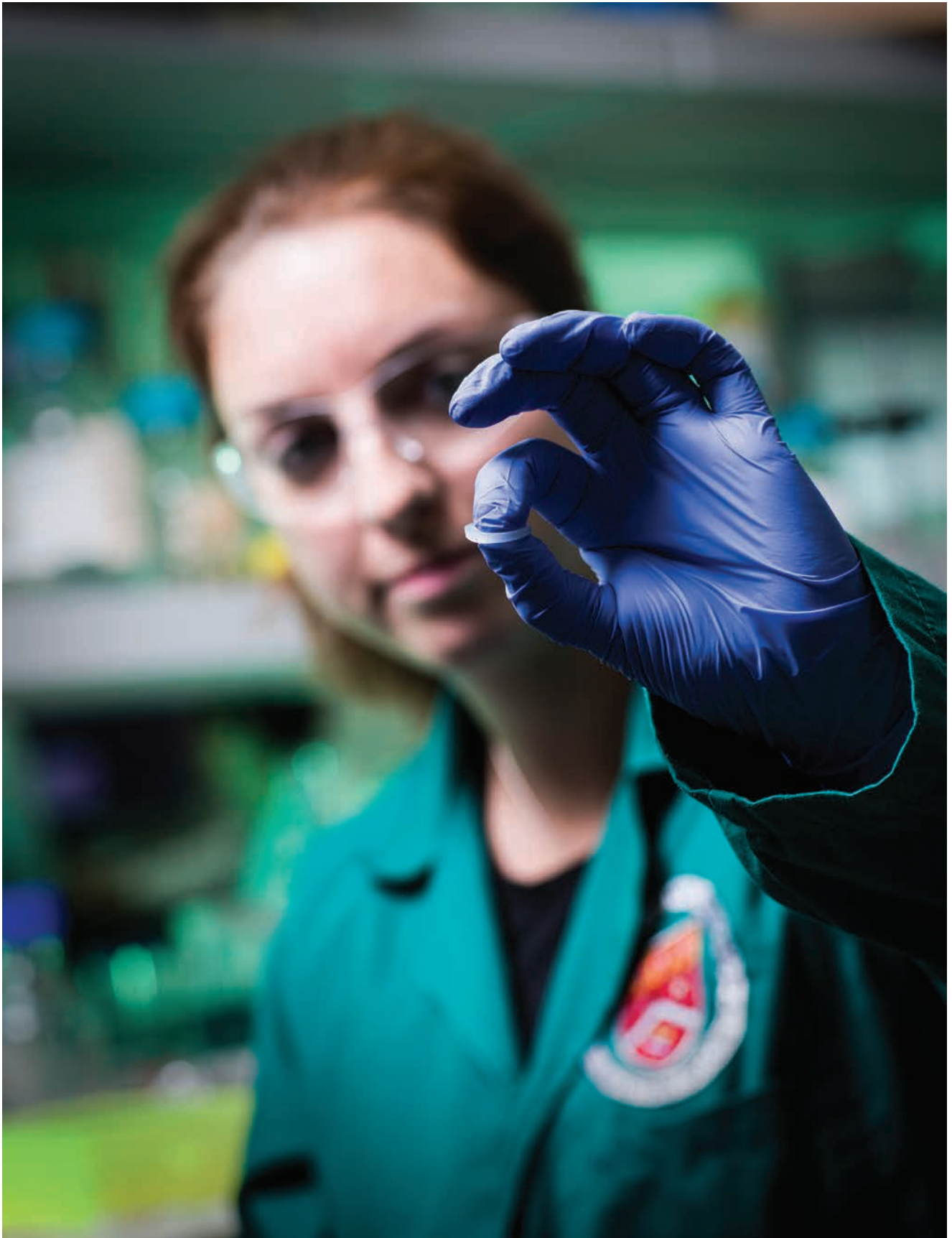
The six infrastructure projects with ACES CIs involved include:

- A project at UOW involving ACES CI A/Prof Attila Mozer aimed at extending the Shared Picosecond Laser Facility to include picosecond-pulse technology and to incorporate new consortium members.

- A project at Deakin involving ACES CI Prof Maria Forsyth aimed at addressing a critical surface characterisation gap in Australian research by the implementation of a glow-discharge optical emission spectrometer.
- A project at UOW involving ACES CI Prof Jun Chen to establish a multi-functional system for investigating surface, interface, and thermal properties of functional materials.
- A project at UOW involving ACES Director Prof Gordon Wallace and ACES CIs Prof Peter Innis, A/Prof Jeremy Crook and ACES AIs Dr Stephen Beirne, Prof Xungai Wang and Prof Peter Choong which aims to develop bioprinting systems that will provide new insights into fundamental biological processes.
- A project at UOW involving ACES CIs Prof Jeremy Crook and Robert Kapsa, that aims to establish a high-throughput, automated patch clamp facility to enable research at the forefront of cell phenotyping and drug discovery.
- A project at UTAS involving ACES CI Prof Brett Paull that aims to establish an advanced, multi-purpose mass spectrometry platform for high-throughput and targeted biomolecular analysis, including proteomics and metabolomics.

ACES Director Prof Gordon Wallace said the funding tranches reflect the calibre and relevance of research coming from and underpinned by ACES researchers.

"All of these funded projects reflect the strength of the ACES core program and the ability of our researchers to build on this to create new opportunities for Australia," he said.



Key Performance Indicators

KEY PERFORMANCE INDICATOR (KPI)	TARGET 2015	ACTUAL 2015	TARGET 2016	ACTUAL 2016	TARGET 2017	ACTUAL 2017
Research Findings						
Number of research outputs- Journal publications	105	190	110	220	120	190 (Scopus 9.1.18)
Number of research outputs- Book chapters	0	6 book chapters	1	6 book chapters	1	1 Book 'Ionic Liquids' 6 book chapters
Number of research outputs- Conference publications	20	133 9 refereed papers 124 unpublished abstracts*	30	152 6 refereed papers 146 unpublished abstracts*	30	145 8 refereed papers 137 unpublished abstracts*
Number of research outputs- Patents (filed)	0	2	1	4 PCT : – PCT/AU2016/051172 Sodium ion electrolyte composition – PCT/AU2016/050886 Apparatus and method for handling free-form Biofabrication Provisional: 'High-efficiency electrochemical conversion of nitrogen into ammonia' – 016900354 – 2016900613 'Nanostructured electrode CO ₂ ', 2016903555	2	2 PCT/AU2017/000036 'High-efficiency electrochemical conversion of nitrogen into ammonia' WS 2017-053-01 'Method and cell for conversion of dinitrogen into ammonia'
Quality of research outputs	50% with impact factor >2.95	138 (73%)	50% with impact factor >3.00	165 (75%)	50% with impact factor >3.1	145 (76%)
Quality of research outputs - H index (ISI) Centre Researchers	5 > 50 4 > 30 6 > 25 6 > 20 3 > 15	5 > 50 7 > 30 9 =or > 25 5 =or > 20 3 > 15	5 > 50 6 > 30 8 > 25 8 > 20 1 > 15	6 > 50 11 > 30 5 > 25 4 > 20	6 > 50 7 > 30 9 > 25 7 > 20 1 > 15	6 > 50 16 > 30 4 > 25 1 > 15

KEY PERFORMANCE INDICATOR (KPI)	TARGET 2015	ACTUAL 2015	TARGET 2016	ACTUAL 2016	TARGET 2017	ACTUAL 2017
Quality of research outputs - Overall publication and citation activity of ACES publications since 2014 (SciVal Scopus). World average field weighted citation impact is 1.00.	Field weighted citation impact : • Overall • Materials Science • Engineering Outputs in : – top 10% most cited – top 10% journals	Field weighted citation impact for ACES 2014-15 (SciVal ,Scopus data 25.1.16) – Overall 1.81 (328 pubs) Outputs in : – top 1% most cited: 17 (5.2%) – top 10% most cited: 140 (42.7%) – top 10% journals: 164 (52%)	Field weighted citation impact: • all research areas Overall: Outputs in : – top 10% most cited – top 10% journals	Field weighted citation impact for ACES 2014-16 (SciVal ,Scopus data 9.1.17) – Overall 1.91 (563 pubs) Outputs in : – top 1% most cited: 10 (4.9%) – top 10% most cited: 207 (38.3%) – top 10% journals: 280 (54.1%)	Field weighted citation impact: • all research areas Overall: Outputs in : – top 10% most cited Views in – top 10% world % views	Field weighted citation impact for ACES 2014-17 (SciVal ,Scopus data 9.1.18) – Overall 1.84 (745 pubs) Outputs in : – top 1% most cited: 48 (6.6%) – top 10% most cited: 293 (40.6%) Views in: – top 1% of world %: 68 (9.4%) – top 10% of world %: 399 (55.3%)
Number of invited talks/papers/keynote lectures given at major international meetings.	30	94 20 Plenary/Keynote 57 invited 17 'distinguished visitor' lectures	30	81 20 Plenary/Keynote 54 invited 7 'distinguished visitor' lectures	30	110 23 Plenary/Keynote 84 invited 3 'distinguished visitor' lectures
Number and nature of commentaries about the Centre's achievements	100 web 20 print 10 radio 5 TV	209 web 40 print 18 radio 12 TV	100 web 20 print 10 radio 5 TV Social media KPI targets are a 10% increase on previous year actual ACES facebook: 862 followers ACES Electromaterials_ YouTube: 261,684 Twitter ARC_ACES: 389 followers	105 web 26 print 22 radio 10 TV ACES facebook: 1000 followers ACES Electromaterials_ YouTube views: 308,500 Twitter ARC_ACES: 511 followers	100 web 20 print 10 radio 5 TV Social media KPI targets are a 10% increase on previous year actual ACES facebook: 1100 Followers ACES Electromaterials_ YouTube views: 339,350 Twitter ARC_ACES: 562 followers	212 web 33 print 26 radio 24 TV ACES facebook: 1140 followers (increase 14%) ACES Electromaterials YouTube views: 348,534 (Increase 13%) Twitter ARC_ACES: 697 followers (increase 36%)
Citation data for publications	1.5 Av cumulative citations per publication (SciVal 2014-2015 SCOPUS list)	3.6 Av cumulative citation per publication 354 articles 1258 citations	3 Av cumulative citations per publication (SciVal 2014-2016 SCOPUS list)	6.0 Av cumulative citation per publication 544 articles 3290 citations	8 Av cumulative citations per publication (SciVal 2014-2017 SCOPUS list)	11.0 Av cumulative citation per publication 745 articles 7345 citations
Research training and professional education						
Number of professional training courses for staff and postgraduate students attended	6	16	9	25	10	29

KEY PERFORMANCE INDICATOR (KPI)	TARGET 2015	ACTUAL 2015	TARGET 2016	ACTUAL 2016	TARGET 2017	ACTUAL 2017
Number of Centre attendees at all professional training/development courses offered by the Centre	40	360	40	>330	40	>320 See Table 4 for examples.
Number of new postgraduate students working on core Centre research and supervised by Centre staff	24	13 Total 27 post graduates	0	3 Total 30 post graduates	12	9 Total 35 post graduates (15 Female)
Number of new postdoctoral researchers recruited to the Centre working on core Centre research	16.4 FTE Total	New to Centre in 2015 4.7 FTE Total 24 FTE post doc researchers	16.4 FTE Total	New to Centre in 2016 3 FTE Total 27 FTE post doc researchers. Note: some members were in ACES for only part of the year.	16.4 FTE Total	New to Centre in 2017 3.35 FTE Total 25.8 FTE post doc researchers
Number of new Honours students working on core Centre research and supervised by Centre staff	0	1	0	2	0 In kind honours students will be determined on a project by project basis as the Centre progresses	1
Number of postgraduate completions and completion times, by students working on core Centre research and supervised by Centre staff	0	0	0	2 Noble: Feb 12 –Jun 16 Lee: Mar13–July16	6	2 Al-Masri: 2014– 2017 Chen: 2014–2017
Number of Early Career Researchers (within five years of completing PhD) working on core Centre research	8	15.5 FTE	Once recruited maintain levels across Centre lifetime; noting some may no longer be ECR	15.6 FTE	Once recruited maintain levels across Centre lifetime; noting some may no longer be ECR	13.8 FTE (7 Female)
Number of mentoring programs offered by the Centre	2	21 events see Appendix 6	2	24 events see research training chapter	3	29 events see research training chapter
Establish international masters course	1 within first 2 years of operation	1	1 within first 2 years of operation	2	1 within first 2 years of operation	2 were established in 2016
International, national and regional links and networks						
Number of international visitors and visiting fellows (VF)	30	57	40	71 (48 visitors / VF and 23 student interns)	50	71 (44 visitors/VF and 27 student interns)

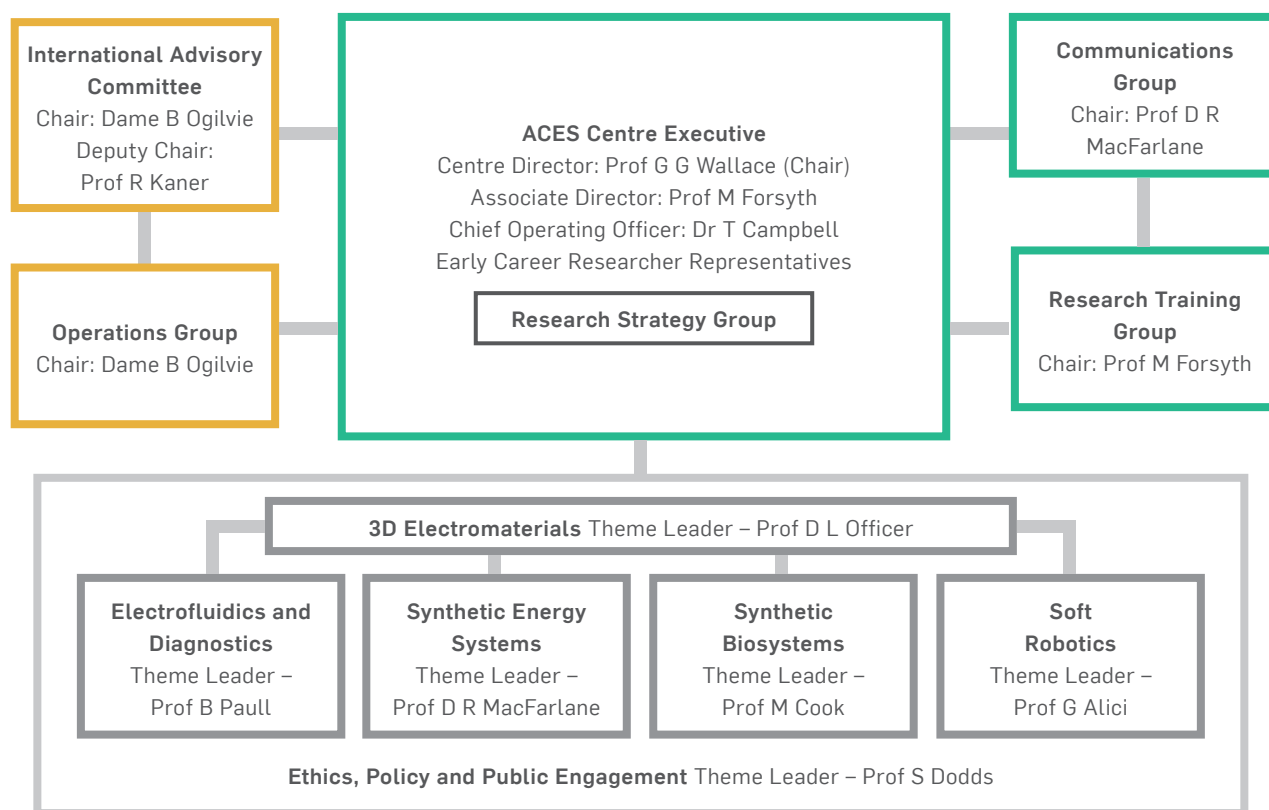
KEY PERFORMANCE INDICATOR (KPI)	TARGET 2015	ACTUAL 2015	TARGET 2016	ACTUAL 2016	TARGET 2017	ACTUAL 2017
Number of national and international workshops held/organised by the Centre	2	7	2	15	2	17
Number of visits to overseas laboratories and facilities	20	66	30	89	30	69
Examples of relevant interdisciplinary research supported by the Centre	30% of journal publications each year will be apportioned across at least 2 FOR codes at the 2 digit level	64% ERA ARC journal FOR codes were used.	30% of journal publications each year will be apportioned across at least 2 FOR codes at the 2 digit level	66% ERA ARC journal FOR codes were used.	30% of journal publications each year will be apportioned across at least 2 FOR codes at the 2 digit level	68.25% ERA ARC journal FOR codes were used.
End-user links						
Number of government, industry and business community briefings	15	48	18	50 business briefings at ACES visits by ACES members to stakeholders 29 9 ACES events held for end-users	21	86 business briefings at ACES visits by ACES members to stakeholders 26 10 ACES events held for end-users
Number and nature of public awareness/outreach programs	5 3 public lectures 1 open day 1 school visit	24 13 public lectures 2 open days 9 school visits	5 3 public lectures 1 open day 1 school visit	28 19 public lectures 3 open days 6 school visits	5 3 public lectures 1 open day 1 school visit	26 10 lectures open to the public 10 events, including 3 open days 6 school visits
Currency of information on the Centre's website	One new content item uploaded onto the website each week	Average 6 new blogs per month Jan-7 Feb-9 Mar-8 Apr-5 May-6 Jun-5	One new content item uploaded onto the website each week Jan-7 Feb-9 Mar-8 Apr-5 May-6 Jun-5	Average 5.25 new blogs per month Jan-4 Feb-3 Mar-3 Apr-3 May-4 Jun-6	One new content item uploaded onto the website each week Jan-7 Feb-8 Mar-8 Apr-8 May-6 Jun-3	Average 3.3 new blogs per month Jan-2 Feb-2 Mar-3 Apr-3 May-5 Jun-2
Number of website hits	Average 1300 sessions/mth	Average 3230 sessions/month	Average 1600 sessions/mth	Average 2866 sessions/month	Average 1900 sessions/mth	Average 2584 sessions/month
Number of talks given by Centre staff open to the public	3	12	3	14	3	10
Establish Fabrication Fellow program	1 within first 2 years of operation	0	1 within first 2 years of operation	Established	1 within first 2 years of operation	Established

KEY PERFORMANCE INDICATOR (KPI)	TARGET 2015	ACTUAL 2015	TARGET 2016	ACTUAL 2016	TARGET 2017	ACTUAL 2017
The adequacy of the Centre's performance measure targets	KPIs reviewed annually at the February IAC meeting; with any changes requested through the ARC	Adequate reviewed by IAC 11 Feb 2016	KPIs reviewed annually at the February IAC meeting; with any changes requested through the ARC	Adequate Reviewed by IAC 9 Feb 2017	KPIs reviewed annually at the February IAC meeting; with any changes requested through the ARC	Adequate Reviewed by IAC 6 Feb 2018
Effectiveness of the Centre in bringing researchers together to form an interactive and effective research team	40% of researchers to have cross-nodal supervision	63%	40% of researchers to have cross-nodal supervision	63%	45% of researchers to have cross-nodal supervision	57%
Effectiveness of the Centre in bringing researchers together to form an interactive and effective research team	35% of ACES publications co-authored with international collaborators	79%	40% of ACES publications co-authored with international collaborators	56.3% (SciVal-SCOPUS list 9.1.17)	40% of ACES publications co-authored with international collaborators	57.5% (SciVal-SCOPUS list 9.1.18)
Effectiveness of the Centre in bringing researchers together to form an interactive and effective research team	15% of ACES publications co-authored with national collaborators	33%	19% of ACES publications co-authored with national collaborators	19.9% (SciVal-SCOPUS list 9.1.17)	21% of ACES publications co-authored with national collaborators	33.5% (SciVal-SCOPUS list 9.1.18)
An annual survey of Centre members re interaction effectiveness		An 'open to the floor' session, entitled 'What is ACES? How can we make it better?' was run at the ACES Full Centre meeting 12 August 2015		The ACES Full Centre meeting is the forum where members are asked for their views on interaction within the Centre. Meeting 21-22 September 2016.		ACES Full Centre meeting is the forum where members are asked for their views on interaction within the Centre. Meeting held 20 July 2016.
National Benefit						
Contribution to the National Research Priority-Frontier Technologies for Building & Transforming Australian Industries in the goal areas of Advanced Materials, Frontier Technologies, Breakthrough Sciences.	20% of ACES publications	50% of ACES publications were coded with FOR codes of: '03' -Chemical Sciences '09'-Engineering '10'-Technology MD-multidisciplinary	20% of ACES publications	76.5% of ACES publications were coded with FOR codes of: '03' -Chemical Sciences '09'-Engineering '10'-Technology (19.2%) MD-multidisciplinary (57.3%)	20% of ACES publications	70.9% of ACES publications were coded with FOR codes of: '03' -Chemical Sciences '09'-Engineering '10'-Technology MD-multidisciplinary
Contribution to the National Research Priority-Frontier Technologies for Building & Transforming Australian Industries in the goal areas of Advanced Materials, Frontier Technologies, Breakthrough Sciences.	10% of public conferences, government and industry briefings, and communiques	49% of ACES conferences, government and industry breakfasts symposia	10% of public conferences, government and industry briefings, and communiques	56% of ACES conferences, government and industry breakfasts symposia	10% of public conferences, government and industry briefings, and communiques	47% of ACES conferences, government and industry breakfasts symposia

KEY PERFORMANCE INDICATOR (KPI) DESCRIPTION - LEVEL AND QUALITY OF INFRASTRUCTURE PROVIDED TO THE CENTRE	
<p>On an annual basis in the ARC report ACES will report on additional</p> <p>i. laboratory space available at the various nodes</p> <p>ii. comment on additional successful funding for new equipment or facilities</p>	
Actual Reporting per Year of Centre	
2014	<p>ANFF materials node, a partnership with ACES at UOW, purchased a Twin Screw Extruder \$179,450.</p> <p>LEIF 2014 Prof Shi Xue Dou, Dr Germanas Peleckis; Prof Xiaolin Wang; Prof Roger Lewis; Prof Geoff Spinks (ACES CI) collaborating with UNSW, Uni Sydney, Deakin: \$420,000- New Generation Cryogen-Free Physical Property Measurement System.</p>
2015	<p>Deakin University have new characterisation tools available:</p> <p>I. a Netzsch DSC 214 Polyma used to study thermal phase change behaviour in samples</p> <p>II. a JEOL JSM-IT300LV a low vacuum scanning electron microscope with a sample transfer chamber for air-sensitive samples</p> <p>III. a differential scanning calorimeter for use in measuring a number of characteristic properties of a material</p> <p>IV. UV-VIS spectrophotometer and electrochemistry flow cell</p> <p>Melbourne University (St Vincents Hospital) have for characterisation a FACS analyser for rapid through-put characterisation of stem cells and cells differentiated from them plus the effects of materials and fabrication on cell phenotype</p> <p>ARC LIEF16 (LE160100063) grant awarded to purchase an advanced focused ion beam microscope with secondary ion mass spectrometer for trace element analysis and nanomachining of soft and hard matter to be located at UOW.</p> <p>ARC LIEF16 (LE160100120) grant awarded to purchase a dynamic nuclear polarisation system for molecular structure determination to be located at Deakin University.</p> <p>ARC LIEF16 (LE160100051) grant awarded to maintaining and enhancing merit-based access to the NCI National Facility. CI Coote from ANU is aCIs on this grant.</p>
2016	<p>Deakin University Deakin University (Burwood campus) have two new laboratories that consist of 4 rooms (hand-over on the 17 November and full operation mid-December).</p> <ul style="list-style-type: none"> - Analysis lab - 25m². - Battery and Corrosion characterisation and analysis lab - 77m² <p>New equipment in the space includes:</p> <ul style="list-style-type: none"> - 5-Digit Mettler Toledo Dual Range Analytical Balance - Lovis rolling ball viscometer / DMA Density meter <p>Deakin University (Waurin Ponds campus) - two new wet spinning lines were installed in 2016.</p> <p>ARC LIEF (LE160100120) ACES CI Forsyth was an investigator named on this LEIF for a Dynamic Nuclear Polarisation System for molecular structure determination. CI Forsyth was also on a successful ARC LIEF (LE170100200; \$635,000) with the University of Melbourne for a high-performance cloud resource for computational modelling to provide high-fidelity predictive models and simulations that will underpin research in critical fields of science and engineering.</p> <p>Monash University has provided new laboratory space for the MacFarlane Group in the Green Chemical Futures building - the facilities are significantly more modern with a small increase in the space available.</p> <p>New equipment in this space includes:</p> <ul style="list-style-type: none"> - Battery Testing Equipment (BTS4000-5V1mA-8CH from Neware Technology Ltd) - an array of analytical equipment testing the charge/discharge performance for electrochemical devices (ie. batteries, supercapacitors, etc.) able to conduct up to 64 different experiments concurrently. - Argon glovebox (Korea Kiyon) - this glovebox compliments the Monash already extensive collection of inert atmosphere gloveboxes. The glovebox is state of the art is specifically for electrochemical reactions and analysis, with a heavy emphasis on lithium, sodium and magnesium battery research. <p>CI Spiccia was part of a successful ARC LIEF (LE170100233; \$1.8m) at Monash University for installation of an Ultra TEM facility to analyse materials structure at the atomic level.</p>

KEY PERFORMANCE INDICATOR (KPI) DESCRIPTION - LEVEL AND QUALITY OF INFRASTRUCTURE PROVIDED TO THE CENTRE	
2017	<p>UOW: Director G Wallace was part of a successful ARC LIEF (LE170100140; \$1.06m) with The University of Sydney for a multiple ion beam facility for microscopy and nanofabrication. This project would increase the ability to observe and manipulate the structure of materials at the nanometre length-scale.</p> <p>UOW purchased a range of new 3D printers and accessories:</p> <ul style="list-style-type: none"> – Markforged Mark2 Carbon fibre 3D printer – 4x Inkredible Bioplotters – ABB IRB120 Robotic arm – Blueprinter M2 – EF010-00281R LED light meter <p>Swinburne: ACES welcomed Swinburne as a node in 2016. They have PC2 labs, characterisation and general chemical labs of approx 1000m². Characterisation tools include: Raman, HPLC, SEM, EChem, AFM, plasma polymerisation systems, QCM, Ellipsometry and XPS.</p> <p>ANU: ARC LIEF (LE170100023; \$650,000) Prof Michelle Coote et al to establish Australia's first a high-field (3 T, 94 GHz) high-field pulse electron paramagnetic resonance (EPR) facility. Accurately determining molecular structure and understanding how molecules interact with light is important to design and optimise new materials. The facility will allow the creation of new materials with application in pharmaceuticals, separation science, organic optoelectronics and magnetic materials.</p>
	<p>UOW: Cls Wallace, Crook, Innis, Wang and Als Choong, Beirne and Sutton were successful in obtaining an ARC LIEF (LE180100175; \$347,070) to develop bioprinting systems to gain fundamental insights into biological processes.</p> <p>Cls Crook and Kapsa were part of a successful ARC LIEF (LE180100066; \$443,311) at UOW to establish a high-throughput, automated patch clamp facility to enable research at the forefront of cell phenotyping and drug discovery.</p> <p>Cl Chen was part of a team on the ARC LIEF (LE180100141; \$326,367) to establish a multi-functional system for investigating surface, interface, and thermal properties of functional materials at UOW. The instrumentation features thermo-gravimetric, infra-red imaging hyphenated with gas-chromatography-mass spectrometry.</p> <p>Cl Mozer joined with colleagues on a successful ARC LIEF (LE180100060; \$563,390) to extend the Shared Picosecond Laser Facility at UOW to include picosecond-pulse technology and to incorporate new consortium members. The Facility, shared among members at four universities and building on over 23 years of collaboration, continues to provide access to state-of-the-art lasers.</p> <p>Cl Crook was part of a team awarded a Research Equipment Grant, University of Wollongong Faculty of Science Medicine & Health (\$72,118) to purchase a Multichannel (MEA2100) Electrophysiology System.</p> <p>Cl Chen was also on two successful UOW major equipment grant projects for AIM at UOW: (i) in-situ nano-mechanical testing inside transmission electron microscopy and (ii) a complete materials characterisation facility for thermomechanical and thermoelectronic properties.</p> <p>DEAKIN: Cls Forsyth and Howlett led a successful ARC LIEF (LE180100168; \$264,706) for a project to address a critical surface characterisation gap in Australian research by the implementation of a glow-discharge optical emission spectrometer.</p> <p>In 2017 the DNP-NMR instrument was installed at Bio21 Institute at the University of Melbourne. This instrument is the first of its kind in Australia and was funded via ARC LIEF LE160100120 on which Deakin was a participant.</p> <p>UTAS: Cl Pauli was part of a successful ARC LIEF (LE180100059; \$350,790) for a project that aims to establish an advanced, multi-purpose mass spectrometry platform for high-throughput and targeted biomolecular analysis, including proteomics and metabolomics.</p>

Governance



ACES Governance Structure

Highly effective engagement at many levels has underpinned the success of ACES in tackling the big multidisciplinary research challenges. None of this has been possible without the commitment of highly talented individuals to ACES research, administration, communication, and governance teams.

The Centre's governance structure aims to ensure the efficient operation of the Centre across multiple locations and is focused on achievement of Centre objectives through specialist committees and advisory groups informing the Centre Executive. The Governance arrangements provide the

appropriate mix of strategic planning and day to day management and ensure proper engagement with key stakeholders.

The initial ACES governance structure (p 93, Annual Report 2016) enabled engagement of expertise from across the nodes in global strategy (by the Global Engagement Group (GEG)) and commercial developments (by the Commercialisation Development Group (CDG)). Having fulfilled their purpose these two governance groups ceased to be part of the Centre's formal governance structure in 2017 and the schematic 'ACES Governance Structure' reflects these changes.

The approaches refined by the groups are being utilised going forward through the Research Training and Communications groups. Chairs of the GEG and CDG, Profs Chicharo and Glynn, now sit on the International Advisory Committee with their expertise still available to implement previously agreed strategies across the nodes.

ACES

The Director Prof Gordon Wallace is passionately committed to fundamental research that can be translated into real outcomes for our community. Gordon is ably supported by Prof Maria

Forsyth as Deputy Director, and a strong research leadership team. Senior CIs in their role as research theme leaders on the ACES research strategy group, mentor other CIs as deputy theme leaders who in 2017 are now leading many of the activities within the ACES themes.

- RF Crisitina Pozo-Gonzales, CI A/Prof Patrick Howlett and SRF Caiyun Wang co-ordinate the SES theme meetings, research group discussions and specialised workshops.
- Prof Robert Kapsa and A/Prof Jeremy Crook drive the SBS research activities.
- A/Prof Jennifer Pringle assists in the co-ordination of the EM theme activities.

As we transit to focus our research onto strategic applications, the relevant theme leaders (and deputies) are assuming greater responsibility for communication of findings and dissemination of knowledge accumulated.

ACES OPERATIONAL ARRANGEMENTS

The Chief Operations Officer (COO) manages the Centre's day-to-day operations in consultation with the Centre Director and the Chairs from the ACES governance committees, where required. The Director and COO work daily with the ACES communications and media officers to ensure communication of key messages within the Centre as well as to stakeholders outside the Centre.

CENTRE EXECUTIVE COMMITTEE

The Centre Executive Committee oversees the Centre's operations and reviews performance against defined indicators and is responsible for reporting outcomes to the ARC and other stakeholders and for setting strategic directions and broad budget allocations. The committee is

advised by the International Advisory Committee.

ACES appoints CIs and ECRs to the ACES Executive Committee for 12 months as part of the mentoring arrangements within the Centre. ECR Binbin Zhang and CI Jeremy Crook (2015-16) and ECR Justin Bourke, RF Natalie Ralph and CI Marc in het Panhuis (2016-17).

The executive committee met four times in 2017 (March, May, July and November) as well as attending the IAC meeting in February. The committee reviewed and endorsed the activities of its sub-committees (Research Strategy Group, Research Training Group and Communications Group).

INTERNATIONAL ADVISORY COMMITTEE

The role of the International Advisory Committee (IAC) provides high-level strategic advice to the Centre Director into the positioning of the Centre's activities to secure and retain a position of global leadership in electromaterials science as well as ongoing input into the Centre's research programs.

Members are appointed for an initial term of 2 years, taking into consideration disciplinary balance, spread and continuity. As indicated in Table 10 the membership group has changed in line with the Centre's transition from building the fundamental knowledge pool of science towards the use of this knowledge to create high impact outcomes in electrofluidics and diagnostics, soft robotics, synthetic energy systems and synthetic biosystems.

Profs Daoben Zhu, Yoshihito Osada and Dr Ian Dagley completed their terms on the IAC at the February 2017 meeting. ACES sincerely thank them for their valued inputs into the Centre over the years, especially as members of the ACES IAC.

OPERATIONS GROUP

The operations group comprises of the DVC (Research) from each of the collaborating organisations or an agreed representative. The meetings chaired by Dame Bridget Ogilvie (IAC chair) address cross-institutional matters. The Operations Group met on 24 February in 2017 to be apprised of ACES activities.

RESEARCH STRATEGY GROUP

The key goal of the Research Strategy Group (RSG) in 2017 was to drive ACES interconnecting theme projects, as well as coordinate theme activities to maximise synergies that arise from the diverse skill-sets of the researchers. This group also discussed emerging research opportunities. Chaired by the Centre Director Prof Gordon Wallace, the RSG met February and July in 2017.

RESEARCH TRAINING GROUP

Mentored by CI Prof Maria Forsyth, CI A/Prof Jennifer Pringle took over the role of Chair of the Research Training Group (RTG) in 2017. This group was responsible for designing, establishing and implementing the research training and career development program. Outside the research it was agreed that the most important contribution ACES could make is in delivering advanced teaching and learning practices; especially in post graduate training. The delivery of the two new Masters courses: Biofabrication and Electromaterials highlight these practices.

CIs Pringle, Innis and Mozer have designed, co-ordinated and run the Electromaterials Masters program.

The Research Training Group (RTG) met three times in 2017, February, July and December. In addition, the working

TABLE 10: ACES IAC Membership 2014 to present

NAME	EXPERTISE	SERVICE YEARS
Dame Bridget Ogilvie (Chair)	CEO Wellcome Trust; Board Director pharmaceutical company AstraZeneca and Lloyds TSB Bank	2005 - ongoing
Prof Ric Kaner (Deputy Chair)	Distinguished Prof at the University of California, Los Angeles (UCLA). World authority on graphene.	2007 - 2013 2016 - ongoing
Prof Michel Armand	Directeur de Recherche at Centre National de la Recherche Scientifique (CNRS); co-leader at CIC energigune (energy co-operative research centre).	2018 - ongoing
Prof Ray Baughman	Director of the MacDiarmid Centre for Nanotechnology, USA. World authority on electromaterials, fibres and actuation.	2005 - ongoing
Prof Joe Chicharo	Deputy Vice-Chancellor (Academic) at UOW; formally DVC (Global Strategy).	2017- ongoing
Prof Robert Cowan	CEO of the HEARing Cooperative Research Centre and HEARworks, its commercial arm. Authority on bioengineering and biomedical research and translation activities.	2016 - ongoing
Prof John Glynn	Emeritus Prof, Sydney Business School, UOW; former Exec Dean, UOW Business Faculty.	2017 - ongoing
Dr Anita Hill	Executive Director, CSIRO Future Industries & Chief Scientist, CSIRO. Authority on electromaterials and nanotechnology and a very experienced board member.	2014 - ongoing
Dr Russell Jones	Bio-MPD Leader, Cell and Gene Therapy Platform, Biopharm R&D, GlaxoSmithKline. Electro-analytical chemistry, expertise in new biomedical venture commercialisation.	2014 - ongoing
Dr Warren King	Chair, Scientific Advisory Board, Cap-XX Ltd and independent adviser on management of R&D at CAP-XX. Previously Group Executive for IT Manufacturing and Services at CSIRO.	2018 - ongoing
Dr Jan Weber	Senior technical & management positions within Boston Scientific, a world leading medical company. Experience in development & application of medical devices.	2014 - ongoing
Prof Chung-Yu (Peter) Wu	Prof, National Chiao Tung University, Director Nanotechnology Program, Taiwan. Authority on biomedical and nano electronics with research collaborations with high-tech industries.	2014 - ongoing
Prof Hans-Joachim Freund	Director Fritz-Haber-Institut der Max-Planck-Gesellschaft, Germany. Authority on catalysis and nanostructures, vast experience on scientific and advisory boards.	2014 - 2018
Prof Lee Won-Mook	President Hanbat University, Korea. Authority on bioengineering and more recently involved in 3D printing technology.	2014 - 2018
Dr Ian Dagley	CEO CRC for Polymers, Australia. Authority on polymers and translation activities.	2014- 2017
Prof Yoshihito Osada	Former Deputy Director RIKEN Advanced Science Institute, Japan. Expert polymer gels.	2014 - 2017
Prof Daoben Zhu	Former Director at Chinese Academy of Science. Molecular materials/devices expert.	2014 - 2017

group for the MPhil Electromaterials had regular meetings throughout the year.

COMMUNICATIONS GROUP

The ACES Communication Strategy supports the broad ACES organisational goal of becoming the pre-eminent world centre for electromaterials science research. Awareness and perception play a key role in achieving this goal and as such, a dynamic and effective communications plan is vital to the Centre's success.

The communications group met three times in 2017, February, August and December with a new look membership team.

The Communications Group discusses issues and strategies around the goal of reaching ACES KPIs and achieving our overall mission as stated in the ACES strategic plan; that is to educate, inspire and engage stakeholders and the broader community, by effectively communicating our research messages.

ACES outreach efforts involve 6 key stakeholder audiences (5 external to ACES).

ACES has been enjoying good media coverage across a number of research topics. Facebook, YouTube, Twitter and LinkedIn platforms all have an increased ACES presence.

The ACES internal community (members and affiliates) is widespread, across 13 institutions worldwide. A 2016 survey found ACES members lack

sufficient knowledge of the broader mission of the Centre and its activities. To address this issue ACES has since implemented:

- A monthly 'ACES all' virtual meeting covering the broader ACES researcher aims.
- The communication team runs targeted educational activities and training sessions at each full centre meeting, with the aim of producing a body of staff and students capable of effectively communicating their work in various contexts.
- A fortnightly internal email newsletter 'ACES news' for staff and students on publications, events and meetings. ACES monitors the 'opens' for the ACES newsletter to gauge reach and interest amongst members.

Stakeholders	Key Messages
1. Global research community	ACES is a national resource in state-of-the-art electromaterials science and integrated device fabrication, with knowledge and facilities that are readily accessible for scientists, engineers, clinicians, regulators and policy makers.
2. Prospective students	ACES provides an inclusive and supportive global research training opportunity; giving access to the most innovative and dynamic research training programs and laboratories in Australia, also facilitated by global connections.
3. Investors	ACES facilitates the development of technologies to create new disruptive business opportunities and to augment existing businesses.
4. Government and Regulators	ACES provides information on the effectiveness of funding programs (for research training) and issues affecting policy and regulation in Energy and Health.
5. Community	ACES provides access to the exciting world of science through open engagement for the community to participate in the wonder of discovery and what can be achieved, using multidisciplinary research to address real community needs so that science can positively impact on people's daily life.
6. Internal	Together we have a common purpose - to build a sense of community for the communication of research progress.

Other Research Developments

ACES members are involved in other research initiatives. In some cases the ACES entity (facilities, personnel and market presence) has enabled the development of these research initiatives that could not be funded by the Centre of Excellence core funding. A list of some of the other research initiatives is shown in Table 11.

The split of other research income secured by Centre staff is shown in the pie chart.

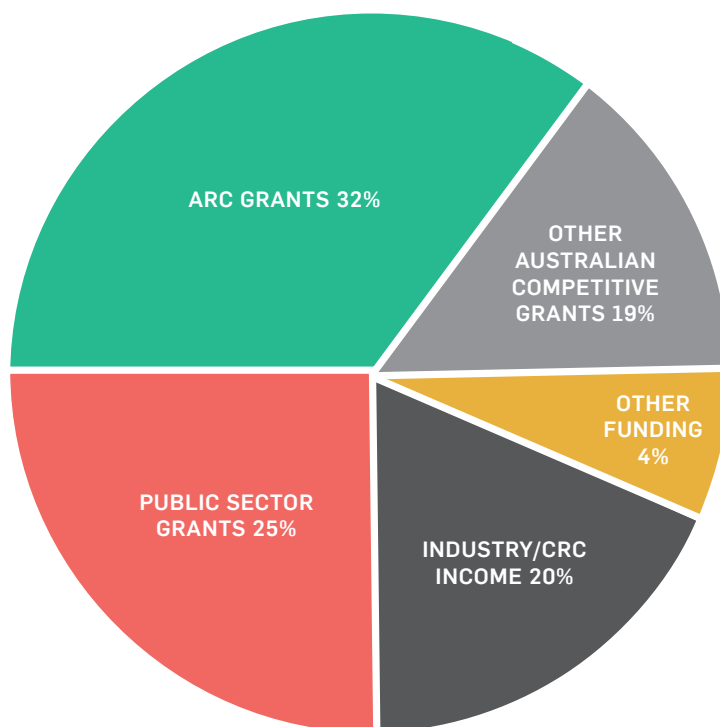


Table 11: Examples of other research initiatives where ACES members are involved

ACES Research Area	Project	Researcher	Funding Body
Chemistry	A Universal Chiral Auxiliary for Controlled Radical Polymerisation.	Prof Michelle Coote	ARC Discovery grant DP 180100139
Materials/ Bionics	Ultra-low fouling active surfaces.	Prof Simon Moulton Prof Robert Kapsa Prof Wren Greene Dr Anita Quigley	ARC Discovery grant DP 180102287
Materials	Multifunctional and environmentally friendly corrosion inhibitor systems	Prof Maria Forsyt Dr Anthony Somers Prof Margaret Ackland Dr Laura Machuca Suarez Prof Herman Terryn	ARC Discovery grant DP180101465
Biosynthetic Biosystems	Critical Slowing in Epilepsy.	Prof Mark Cook Grayden D Kuhlmann L Freestone DR D'Souza W Burkitt AN	NHMRC Project Grant 1130468
Chemistry	Controlling chemical reactions via pH-switchable electrostatic catalysis.	Prof Michelle Coote	ARC Laureate Fellowship FL170100041

ACES Research Area	Project	Researcher	Funding Body
EPPE	Legal and ethical issues in the inheritable genetic modification of humans.	A/Prof Catherine Mills Dr Karinne Ludlow Prof Robert Sparrow Dr Narelle Warren	ARC Discovery grant DP 170100919
Materials/ Fabrication	The true potential and limitations of fibres. This project aims to understand the fibre spinning process of nanomaterials to identify their true potential and limitations in wearable applications.	A/Prof Joselito Razal Prof Xungai Wang Dr Maryam Naebe	ARC Discovery grant DP 170102859
Materials	Increasing solid electrolyte conductivity through defect design. This project aims to engineer electrolyte materials, based on organic ionic plastic crystals, and use isomeric doping to improve the ionic conductivity.	A/ Prof Jennifer Pringle Prof Peter Bruce Dr Anthony Hollenkamp	ARC Discovery grant DP 170101087
Materials	A project to develop and apply a highly advanced integrated research package in dynamic electrochemistry to molecules of biological significance and ionic liquids of industrial importance.	Dr Jie Zhang Prof Alan Bond Prof David Gavaghan Dr Alison Parkin	ARC Discovery grant DP 170101535
Ethics	A project to investigate the legal and ethical implications of technologies that allow inheritable modifications of the human genome	A/Prof Catherine Mills Dr Karinne Ludlow Prof Robert Sparrow Dr Narelle Warren	ARC Discovery grant DP 170100919
Materials/ Energy	Efficient ionic liquid-based reduction of nitrogen to ammonia. This project aims to develop a hybrid ionic liquid-nanostructured electrode platform to electrochemically convert nitrogen gas to ammonia.	Prof Douglas MacFarlane Dr Xinyi Zhang A/Prof Jun Chen Dr Suojang Zhang	ARC Discovery grant DP170102267
Materials/ Energy	A project to synthesise flexible redox gel-electrolyte interpenetrated electrodes for an eco-friendly prototype wearable thermo-electrochemical cell that can power body-worn low-power wearable electronics.	A/Prof Jun Chen Dr Leigh Aldous	ARC Discovery grant DP170102320
Materials/ Characterisation	2017-2020: On-fibre separation science with ambient ionisation mass spectrometry. This project aims to combine fibre-based electrofluidics and ambient ionisation mass spectrometry.	Prof Brett Paull Prof Miroslav Macka Prof Dr Wolfgang Buchberger A/ Prof Peter Innis	ARC Discovery grant DP 170102572

ACES Research Area	Project	Researcher	Funding Body
Materials/ Electrofluidics	A high speed, high fidelity 3D printer for fabricating microfluidic devices. This project aims to develop a novel 3D printer offering the highest resolution available and fastest printing speed for the single-step manufacturing of complex microfluidic devices.	Prof Michael Breadmore Dr Rosanne Guijt Dr Stuart Thickett Prof Brett Paull Mrs Celia Lin	ARC Linkage grant LP160101247 with partner Young Optics Inc
Materials/ Energy	2016-2019: Towards high stability, high energy density Na batteries for widespread energy storage	Prof Maria Forsyth (ACES) A/Prof Patrick Howlett (ACES) Dr Alexey Glushenkov Prof Michel Armand	ARC Discovery grant DP160101178
Materials/ Modelling	2015-2017: Controlling polymer microstructure with structured Lewis acids	Coote, Prof Michelle L (ACES)	ARC Discovery grant DP150104454
Materials/ Characterisation	2015-2017: Electrochemical Resonance Energy Transfer	C Hogan L Spiccia (ACES) P Barnard J Jasieniak	ARC Discovery grant DP150102741
Materials/ Fabrication	2015-2017: This project will explore the potential and limits of chemopropulsion and its use as a driving mechanism for cargo-carrying vehicles in fluids. The resulting fluidic transport systems could be used to transport medicine in the human body, act as chemical messengers for signal transduction in sensing or other systems or move cargo around microfluidic devices.	Officer, Prof David (ACES) Wagner, Dr Pawel (ACES) Wagner, Dr Klaudia Diamond, Prof Dermot Gordon, Prof Keith Florea, Dr Larisa	ARC Discovery Grant DP150104532
Materials	2014-2019: ARC Research Hub for a World-class Future Fibre Industry. This research hub aims to transform the Australian fibre industry into a dynamic sector focused on high-performance and high-value fibres and fibre-based products. These materials are expected to help to reduce energy costs, minimise the environmental footprint of manufacturing processes and improve public health and safety. The hub will also train the next generation of industry-savvy fibre research leaders.	Prof Xungai Wang (ACES) et al	IH140100018

ACES Research Area	Project	Researcher	Funding Body
Materials/ Fluidics	2014: ARC Training Centre for Portable Analytical Separation Technologies. The aim is to discover and create new technologies to enable more portable separation science applications.	Prof EF Hilder A/Prof RA Shellie Prof PR Haddad Prof MC Breadmore Prof B Paull (ACES) Prof PN Nesterenko Dr RM Guijt	IC140100022
Medical Bionics	2014-2017: For the application of intelligent conducting polymers for treating schizophrenia and allied disorders focusing on neuronal outgrowth, myelination and synaptogenesis.	Prof Xu-Feng Huang A/Prof Jeremy Crook (ACES) A/Prof Robert Kapsa (ACES) Prof Gordon Wallace (ACES)	NHMRC grant 1065463
Medical Bionics	2014-2017: Biopolymer Conduit for Peripheral Nerve Repair	A/Prof Robert Kapsa (ACES) Prof Gordon Wallace (ACES) A/Prof Michael Murphy Prof Geoff Spinks (ACES)	NHMRC grant 1062569
Materials Engineering	2014-2017: This project aims to understand the behaviour of haematopoietic stem cells (HSC) in novel 3D scaffolds based on short silk nanofibres.	Wang, Prof Xungai (ACES) Sutti, Dr Alessandra Rajkhowa, Dr Rangam Wong, Dr Cynthia Kirkland, A/Prof Mark A	ARC Linkage Grant LP140100287 with partner Cytomatrix Pty Ltd
Materials	2012–2017: Protonic materials for green chemical futures By emulating the structures that nature has evolved this project will create novel materials that will be used to develop new sustainable chemical technologies. Working with local and international collaborators, outcomes will include new approaches to the conversion of carbon dioxide into valuable chemicals and for renewable energy generation and storage.	Prof DR MacFarlane (ACES)	ARC Laureate FL120100019

2017 Membership

ACES members in 2017 included: 24 Chief Investigators (5 female), 5 Partner Investigators, 1 Chief Operations Officer (female), 0.6FTE Operations Officer (female), 14 Research Fellows (12FTE; 9 female), 3 Engineers, 1 Technical Officer (female), 18 Early Career Researchers (13.8FTE; 7 female) , 35

PhD students (15 female), 2 MPhil EM (1 female) working on core funded projects. In addition ACES has 33 affiliate PhD students (19 female) working on complementary projects and 42 associate investigators (9 female) assisting with projects either as co-supervisors of students or through

collaboration on specific ACES projects within the themes. The Centre also employed casual research assistants and administration staff members.

A list of ACES members indicating their involvement in the various ACES research themes is shown below.

Table 12: A list of ACES Chief Investigators and Partner Investigators

Name	Gender	Node	EM	SES	SBS	SR	EFD	EPE
Chief investigators								
Wallace, Gordon	Male	University of Wollongong	✓	✓	✓	✓	✓	
Officer, David	Male	University of Wollongong	✓	✓				
Alici, Gursel	Male	University of Wollongong	✓			✓		
Chen, Jun	Male	University of Wollongong	✓	✓				
Crook, Jeremy	Male	University of Wollongong	✓		✓			
Higgins, Michael	Male	University of Wollongong	✓		✓			
in het Panhuis, Marc	Male	University of Wollongong	✓		✓	✓		
Innis, Peter	Male	University of Wollongong	✓				✓	
Kapsa, Robert	Male	University of Wollongong	✓		✓			
Mozer, Attila	Male	University of Wollongong	✓	✓				
Spinks, Geoffrey	Male	University of Wollongong	✓	✓		✓		
MacFarlane, Douglas	Male	Monash University	✓	✓				
Zhang, Jie	Male	Monash University	✓	✓				
Sparrow, Robert	Male	Monash University						✓
Forsyth, Maria	Female	Deakin University	✓	✓	✓			
Howlett, Patrick	Male	Deakin University	✓	✓		✓		
Pringle, Jennifer	Female	Deakin University	✓	✓				
Wang, Xungai	Male	Deakin University	✓					
Hancock, Linda	Female	Deakin University						✓

Name	Gender	Node	EM	SES	SBS	SR	EFD	EPE
Paull, Brett	Male	University of Tasmania	✓				✓	
Dodds, Susan	Female	University of Tasmania						✓
Cook, Mark	Male	University of Melbourne	✓		✓			
Coote, Michelle	Female	Australian National University	✓	✓	✓			
Moulton, Simon	Male	Swinburne University of Technology	✓		✓		✓	
Partner Investigators								
Kim, Seon Jeong	Male	Hanyang University, Korea	✓			✓		
Guldi, Dirk	Male	Friedrich Alexander University, Germany	✓					
Watanabe, Masa	Male	Yokohama University, Japan	✓	✓				
Diamond, Dermot	Male	Dublin City University, Ireland	✓				✓	
Unwin, Patrick	Male	Warwick University, UK	✓	✓				

Table 13: A list of ACES Research Fellows, Early Career Researchers, Engineers and Technicians

Name	Gender	Node	EM	SES	SBS	SR	EFD	EPE
Research Fellows								
Kerry Gilmore	Female	University of Wollongong	✓		✓			
Paul Molino (0.1FTE)	Male	University of Wollongong			✓			
Anita Quigley	Female	University of Wollongong	✓		✓			
Eva Tomaskovic-Crook	Female	University of Wollongong	✓		✓			
Pawel Wagner (0.5FTE)	Male	University of Wollongong	✓					
Caiyun Wang	Female	University of Wollongong	✓	✓				
Zhilian Yue	Female	University of Wollongong	✓		✓			
Onofrillo, Carmine (0.25FTE)	Male	University of Wollongong / St Vincents Hospital Melbourne			✓			
Alexandr (Sasha) Simonov	Male	Monash University	✓	✓				
Si-Xuan Guo	Female	Monash University	✓	✓				
Jian Fang	Male	Deakin University	✓					
Cristina Pozo-Gonzalo	Female	Deakin University	✓	✓				

Name	Gender	Node	EM	SES	SBS	SR	EFD	EPE
Natalie Ralph	Female	Deakin University						✓
Naomi Haworth	Female	Australian National University	✓					
Early Career Researchers								
Cormac Fay	Male	University of Wollongong	✓					
Rouhollah Jalili (Jan- March; accepted VC fellowship RMIT)	Male	University of Wollongong	✓	✓	✓			
Rahim Mutlu (Jan-Feb, recruited as lecturer in EIS at UOW)	Male	University of Wollongong				✓		
Andres Ruland	Male	University of Wollongong	✓					
Ashley Walker (Jan-March; recruited to ANFF)	Male	University of Wollongong	✓					
Holly Warren	Female	University of Wollongong	✓		✓	✓		
Binbin Zhang (January; recruited to Hearing CRC then accepted Fellowship in Japan)	Female	University of Wollongong	✓		✓			
Hao Zhou	Male	University of Wollongong				✓		
Qingsheng Zhang (casual)	Male	University of Wollongong			✓			
Yu Chen (casual)	Male	University of Wollongong			✓			
Thomas Robinson (casual)	Male	University of Wollongong			✓			
Maxime Fournier (Max)	Male	Monash University	✓	✓				
Mary Walker	Female	Monash University						✓
Fengling Zhou	Male	Monash University		✓				
Madeleine Dupont	Female	Deakin University		✓				
Ruhamah Yunis (0.1 FTE)	Female	Deakin University	✓	✓				

Name	Gender	Node	EM	SES	SBS	SR	EFD	EPE
Yafei Zhang (0.5FTE Aug-Dec)	Female	Deakin University	✓	✓				
Joan-Marc Cabot Canyelles	Male	University of Tasmania	✓				✓	
Niall MacDonald	Male	University of Tasmania	✓				✓	
Eliza Goddard (0.8FTE)	Female	University of NSW/Tasmania						✓
Justin Bourke	Male	University of Melbourne			✓			
Benjamin Noble	Male	Australian National University	✓					
Technicians /Engineers/Research Assistants								
Adam Taylor Fabrication (July 2017)	Male	Fabrication Engineer University of Wollongong	✓	✓	✓	✓	✓	
Cathal O'Connell Fabrication (0.3FTE July-December)	Male	University of Wollongong/ ACMD St Vincent's Hospital Melbourne	✓		✓			
Kalani Ruberu (0.5FTE February - December)	Female	Bionics technical officer			✓			
Zhigang (Armstrong) Xie (0.2FTE)	Male	Engineer Deakin University	✓					

Table 14: A list of ACES Non-Academic positions

Name	Node	Position	Gender
Non-Academic Positions			
Toni Campbell	University of Wollongong	Chief Operations Officer	Female
Vanessa O'Brien (0.6FTE Nov-Dec)	University of Wollongong	Operations Officer	Female
Natalie Foxon-Phillips (0.4 FTE Jan-June)	University of Wollongong	Communications & Media Officer	Female
Sarah McMaster (0.4FTE Jan-Mar)	University of Wollongong	Communications & Media Officer	Female
Sian Wright (Mar-Dec)	University of Wollongong	Communications & Media Officer	Female

Name	Node	Position	Gender
Lisa Hutton (Jul-Dec)	University of Wollongong	Communications & Media Officer	Female
Delvene McKenzie (Mar-Dec)	University of Wollongong	Administration	Female
Kimberley Twist (Jan-Feb)	University of Wollongong	Casual Administration	Female
Sona Shekibi (0.2FTE)	Deakin University	Administration	Female
Jacqui Sandilands (0.5FTE)	Deakin University	Administration	Female
Helen Woodall (0.5FTE)	Deakin University	Administration Support	Female
Gary Annat (0.4FTE)	Monash University	Administration	Male
Umme Kalsoon (0.15FTE)	University of Tasmania	Administration	Female
Naomi Morter (0.4FTE)	University of Melbourne	Administration	Female

Table 15: A list of ACES postgraduate students working on core Centre research and supervised by Centre staff in 2017

Name (Start Year)	Funding Source	Project Description	Node	Country of Origin	Program Theme	Gender
Core Funded ACES projects						
Eli Abdell Massih (Aug 2017)	ACES	Control system for robotic hand	University of Wollongong	Lebanon	SR	Male
Tom Barsby (2014)	ACES	Electrical stimulation 3D structures – stem cell effects	University of Wollongong/ St Vincent's Hospital Melbourne	UK	SB	Male
Joshua Brooks (2016)	APA	Development of high aspect ratio ordered thermoplastic nano-materials as print media for 3D additive fabrication	University of Wollongong	Australia	EFD/EM/ SR	Male
Zhi Chen (2015)	ACES	Bio inks for stem cells	University of Wollongong	China	EM/SB	Male

Name (Start Year)	Funding Source	Project Description	Node	Country of Origin	Program Theme	Gender
Inseong Cho (March 2017)	ACES	Developing new asymmetric redox mediators with large difference in forward / backward electron transfer rates	University of Wollongong	Korea	EM/SES	Male
Jaechol Choi (2014)	UPA	Electrocatalytic reduction of CO ₂	University of Wollongong	Korea	EM/ SES	Male
Syamak Farajikhah (2014)	ACES	Sensor systems for fluidics	University of Wollongong	Iran	EM/EFD	Male
Hadis Khakbaz (2016)	UPA	Development of high nanofilled (aspect ratio ordered) bio-thermoplastics as print media for 3D additive fabrication.	University of Wollongong	Iran	EM/EFD	Female
Jianfeng Li (2015)	ACES	Electrical Stimulation cell effects-molecular markers.	University of Wollongong	China	SB	Male
Fahimeh Mehropouya (2014)	ACES	Polymeric nanodispersion and growth factors	University of Wollongong	Iran	EM/SB	Female
Christina Puckert (2014)	ACES	Cell-material interactions using Bio-AFM	University of Wollongong	Germany	EM/SB	Female
Alex Nagle (2015)	ACES	Nano-printing	University of Wollongong	Ireland	EM	Male
Aida Shoushtari Zadeh Naseri (Aug 2017)	UPA	3D electrical stimulation in hydrogels	University of Wollongong	Iran	EM/SBS	Female
Bijan Shekibi (Jan 2017)	ACES	Design of an integrated multi-well cell culture system for functional tissue constructs	University of Wollongong/ St Vincent's Hospital Melbourne	Australia	SB	Male
Charbel Tawk (2016)	ACES	Actuators, sensors and support for robotic hand	University of Wollongong	Lebanon	SR	Male
Liang Wu (2015)	ACES	Detection systems for diagnostics	University of Wollongong	China	EFD	Male
Changchun Yu (2014)	CSC ACES	Functional batteries for cellular communications	University of Wollongong	China	SBS	Female

Name (Start Year)	Funding Source	Project Description	Node	Country of Origin	Program Theme	Gender
Manjunath Chatti (2015)	ACES	Photo-processes-MoS ₂ Nanosheets integrated into Graphene matrix for Enhanced Hydrogen Evolution	Monash University	India	EM/SES	Male
Shuo Dong (Oct 2017)	ACES	Synthetic Energy Systems	Monash University	China	SES	Male
Hoang Long Du (Aug 2017)	ACES- Monash	Nanostructured catalysts for electrochemical ammonia synthesis	Monash University	Malaysia	EM/SES	Male
Rebecca Hodgetts (Sept 2017)	APA	Understanding the mechanism of electrocatalytic nitrogen reduction	Monash University	Australia	SES	Female
Changlong Xiao (2015)	ACES- Monash	3D structural control of ionic conduction	Monash University	China	EM/SES	Male
Ying (Sherry) Zhang (2015)	ACES- Monash	Utilization of CO ₂ as C1 building block for electroorganic synthesis in ionic liquids	Monash University	China	SES	Female
Mary Kalani Erangi Periyapperuma Achchige (2015)	ACES	Energy storage for soft robotics	Deakin University	Sri Lanka	SES/SR	Female
Srdan Begic (2014)	ACES	Characterisation and modelling of 3D electrolytes & active metal interphases	Deakin University	Sweden	EM/SES	Male
Mathew Cherian (2015)	ACES	Global Development, Community Development and Energy	Deakin University	India	EPPE	Male
Laura Garcia Quintana (July 2017)	ACES	Enhancement of oxygen reduction mechanism in sodium air batteries	Deakin University	Spain	SES	Female
Jun (Rossie) Rao (2015)	ACES- Deakin	3D nanostructured electrolytes	Deakin University	China	EM	Female
Abuzar Taheri (2015)	ACES	Integrating 3D materials in thermoelectrics-new solid and liquid electrolytes and 3D electrocatalysts for thermal energy harvesting	Deakin University	Iran	SES	Male

Name (Start Year)	Funding Source	Project Description	Node	Country of Origin	Program Theme	Gender
Sidra Waheed (2015)	ACES	3D fabricated micro-fluidic manifolds – design and characterisation	University of Tasmania	Pakistan	EFD	Female
Anna Blum (2016)	ACES	Ethical challenges for electromaterials and neuroscience: the benchtop brain	University of NSW	USA	EPPE	Female
Catherine Simpson (2016-Maternity leave 2017)	ACES	Nitroxides for energy	Australian National University	Australia	EM/SES	Female
Nicholas Hill (2017)	ACES	Modelling 3D spatial effects on radical orbital switching and associated properties, and indeed electric field effects on chemical reactions in general	Australian National University	Australia	EM/SES	Male
Lilith Caballero Aguilar (2015)	ACES	3D printing of Drug Delivery Structures	Swinburne University	Mexico	SBS	Female
Daniela Duc (2015)	ACES	Materials Design and Fabrication of Effective Optical and Electrical Co-stimulation of Cells	Swinburne University	Mauritius	SBS	Female
Shaun Gietman (2015)	ACES	Synthesis of Optically Active Drug Delivery Systems	Swinburne University	Australia	EFD/SBS	Male
Masters students						
Karmjeet Kaur Buttar (2017)	ACES-Deakin	Electromaterials masters	Deakin University	India	SES	Female
Mathew Russo (2017)	ACES-Deakin	Electromaterials masters	Deakin University	Australia	SES	Male
Affiliate ACES projects						
Al-Ghazzawi, Fatimah (2016)	Iraqi Govt	New metal-organic interfaces- new photo-active interfaces for catalytical chemistry and/or energy harvesting/ conversion applications	University of Wollongong	Iraq	EM	Female

Name (Start Year)	Funding Source	Project Description	Node	Country of Origin	Program Theme	Gender
Al-Graiti, Wed (2014)	Iraqi Govt	Development of Functionalized NanoPorous Carbon Fibre Electrodes for Probe-Sensing Technology	University of Wollongong	Iraq	EM	Female
Chao, Yunfeng (2015)	CSC	Fabrication of graphene-based composites for energy storage application	University of Wollongong	China	EM/SES	Male
Chen, Xifang (2016)	UOW-VSS matching	Ulvan fabrication for wound healing	University of Wollongong	China	EM/SBS	Female
Daikuara, Luciana Yumiko (2016)	UOW-IPRI- IHMRI matching	Fabricating delivery system for wound healing- thread based electrofluidics	University of Wollongong	Brazil	EM/SBS	Female
Fan, Yuchao (Feb 2017)	UOW-IPRI matching	Hybrid bioprinted cartilage scaffold based on cellulose nanocrystals reinforced GelMA/HAMA hydrogel	University of Wollongong	China	SBS	Female
Hou, Yu (2016)	UOW-IPRI matching	Develop printable delivery systems, bioinks and bioprinting protocols for islet transplantation	University of Wollongong	Mongolia	SBS	Female
Javadi, Seyed (2014)	Self funded	Developing graphene oxide based composite materials capable of acting as a temperature sensor	University of Wollongong	Iran	EM	Male
Kang, Lingzhi (2016)	UOW- St Vincent's Hospital Matching	Biofabricated platforms (based on collagen) for skin repair and regeneration	University of Wollongong	China	EM/SBS	Female
Khan, Jawairia Umar (2017)	Pakistan HEC & IPTA	Fibre electrofluidics for ambient ionisation mass spectrometry	University of Wollongong	Pakistan	EFD	Female
Kuppanacharry, Praneshwar Sethupathy (Mar 2017)	UPA	Developing new architectures for redox-based energy processes	University of Wollongong	India	EM	Male
Qin, Chunyan (2017)	UOW-IPRI- IHMRI matching	Injectable electrodes - Bipolar Electrochemical Chips for Wireless Cell Stimulation Driven by Electric Field	University of Wollongong	China	EM/SBS	Female
Rahim, Siti Abdul (2014)	Malaysian Gov't & ACES	Studying Schizophrenia Using Induced Pluripotent Stem Cells and Conductive Biomaterials	University of Wollongong	Malaysia	SBS	Female

Name (Start Year)	Funding Source	Project Description	Node	Country of Origin	Program Theme	Gender
Salahuddin, Bidita Binte (2015)	UOW	Hydrogel McKibben Artificial Muscles	University of Wollongong	Bangladesh	SR	Female
Stephens-Fripp, Benajmin (2017)	RTP	A Minimally Invasive Interface between a Prosthetic Hand and its User	University of Wollongong	Australia	SR	Male
Vijayakumar, Amruthalakshmi (2016)	IPTA	N-doped graphene for electrocatalytic reduction of CO ₂	University of Wollongong	India	EM/SES	Female
Wang, Kezhong (Sept 2017)	UOW-IPRI matching	Graphene-based soft electrodes	University of Wollongong	China	EM	Male
Xiao, Yang (2015)	IPTA	The synthesis and characterization of photoactive materials and their use in the chemopropulsion-based fluidic transport systems.	University of Wollongong	China	EM	Male
Yu, Changchun (2014)	CSC/ACES	Functional Batteries for cellular communications	University of Wollongong	China	SES/SBS	Female
Zarghami, Sara (2016)	ARC DP	Development and Study of Chemopropelled Cargo- Carrying Vehicles in Fluids.	University of Wollongong	Iran	EM	Female
Zhang, Long (2015)	UOW-IPRI matching	Electrostatic control over radical reactions at solid/ liquid interfaces	University of Wollongong	China	EM	Male
Zhao, Yong (2015-April 2018)	CSC	CO ₂ reduction on Copper Metal or Copper Oxide electrodes	University of Wollongong	China	EM/SES	Male
Zhou, Ying (Sept 2017)	UPA	Development of multifunctional bioinks for 3D printing cellular constructs	University of Wollongong	China	SBS	Female
Zou, Jinshuo (Sept 2017)	UOW-IPRI matching	Electrocatalytic Nitrogen Reduction at Ambient Temperature and Pressure	University of Wollongong	China	SES	Female
Ali, Muataz (2014)	Iraq Govt	Develop novel semiconductors to efficiently reduce nitrogen into ammonia	Monash University	Iran	SES	Male
Kang, Colin (2016)	APA	Electrochemical reduction of nitrogen gas to ammonia	Monash University	Australian	SES	Male

Name (Start Year)	Funding Source	Project Description	Node	Country of Origin	Program Theme	Gender
Li, Haitao (2014)	ALF	Develop several different kinds of photocatalysts with excellent properties to convert the CO ₂ into fuel or other useful chemicals.	Monash University	China	SES	Male
Ha, The An (Nov 2017)	AISRF	Na-Air cells	Deakin University	Vietnam	SES	Male
Adesanya, Olumayowa (2017)	UTAS	The legal and ethical aspects of bioprinting	University of Tasmania	Nigeria	EPPE	Female
Li, Feng (2015)	UTAS	Microfluidic Devices with Integrated Nanochannels for Sample-in/ Answer-out Analysis of Pharmaceuticals from Body Fluids.	University of Tasmania	China	EFD	Male
Viana, John (2015)	DECRA	Invasive Synthetic Biomedical Brain Devices: Ethical and Policy Implications	University of Tasmania	Philippines	EPPE	Male
Mladenovska, Tajanka (2016 maternity leave 2017)	UOM	Innovation, commercialisation and regulation of 3D-BioPrinted surgically implantable orthopaedic medical devices	University of Melbourne	Macedonia	SBS/EPE	Female
Ngan, Catherine (2015)	UOM	3D Muscle Constructs for Ablated Muscle Injury and Robotics Tissue-Electrode Interfaces	University of Melbourne	Australia	SBS	Female
Masters Projects						
Williams, Joanne (July 2016)		BIOFAB masters - 3D printing Controlled Drug Delivery Systems	University of Wollongong	Australian	EM/SBS	Female

Table 16: ACES Work Submitted for Examination 2017

Name	Project Description	Node	Country of Origin	Program Theme	Gender
Cody Wright	Electro-printing	University of Wollongong	USA	EM	Male
Diogo Cabral	Novel redox couples for redox flow batteries	Monash University	Brazil	SES	Male

Name	Project Description	Node	Country of Origin	Program Theme	Gender
Dijon Hoogeveen	Dye-Sensitized Photocathodes Catalysing Light Driven Reduction	Monash University	New Zealand	EM/SES	Male
Fengwang Li	Photoelectrocatalytic and electrocatalytic reduction of CO ₂ using novel 2D materials	Monash University	China	SES	Male
Masters Student					
Charles Hamilton	Printable tough, thermally-active hydrogel actuators	University of Wollongong	USA	SR	Male
Affiliate Students					
Aziz, Shazed Md	Polymer fibre artificial muscle	University of Wollongong	Bangladesh	EM/SR	Male
Ge, Yu	Graphene and its inorganic analogues based materials for energy storage device	University of Wollongong	China	EM/SES	Male
Gu, Qi	3D Bioprinting for Neural Tissue Engineering	University of Wollongong	China	EM/SBS	Male
Liu, Yuqing	Flexible 3D Electrodes via Extrusion-Printing for Flexible and Wearable Device	University of Wollongong	China	EM	Female
Lu, Zan	Carbon nanotube fiber and its application in garment and wearable sensors	University of Wollongong	China	EM/SES	Male
Zheng, Tian	Development of Magnetoelectric Polymer Composites	University of Wollongong	China	EM/SBS	Female
Halima, Ahmed	Novel Si-based photocathode assemblies.	Monash University	Egypt	SES	Male
Gupta, Vipul	New Composite and Micro/Nanostructured Materials for Chemical Analysis	University of Tasmania	India	EFD	Male

Table 17: Successful Completions in 2017

Name	Degree	Project Description	Node	Program Theme	Gender
Ken Chun	Core PhD	Develop novel nanoporous metals for electrochemical applications	Monash University	SES	Male
Danah Al-Masri	Core PhD	New redox couples and ionic liquid electrolytes for thermal energy harvesting	Deakin University	SES	Female
Reece Gately	Affiliate PhD	3D printed robotic hand	University of Wollongong	SR	Male
Xiaoteng Jia	Affiliate PhD	Biodegradable electrodes for energy storage applications in medical bionics	University of Wollongong	EM/SES	Male
Danial Sangian	Affiliate PhD	Developing a New Type of McKibben Artificial Muscles	University of Wollongong	SR	Male
Shannon Bonke	Affiliate PhD	APA- Co-, Mn- and Ni-oxides from various preparation methods will be examined electrochemically for conversion of solar energy to drive the synthesis of solar fuels	Monash University	SES	Male
Simon Maksour	Awarded First Class Honours	Establishing a novel human neural stem cell model for DISC1 loss-of-function: a valuable tool in molecular studies of neurogenesis and psychiatric disorders	University of Wollongong	SBS	Male

Table 18: Associate Investigators 2017 with ACES acknowledgement or deeds in place

Name	ACES Node	AI affiliation	Program Theme
Beirne, Stephen	University of Wollongong	UOW, Australia	EM- fabrication
Ciampi, Simone	University of Wollongong	UOW, Australia	EM
Chen, Jun	University of Wollongong	UOW, Australia	EM/SES
Esrafilzadeh, Dorna	University of Wollongong	RMIT, Australia	EM/SBS
Foroughi, Javad	University of Wollongong	UOW, Australia	EM
Harris, Alex	University of Wollongong	UOW, Australia	EM/SBS

Name	ACES Node	AI affiliation	Program Theme
Huang, Xu-Feng	University of Wollongong	UOW, Australia	SBS
Jalili, Rouhollah (Ali)	University of Wollongong	RMIT, Australia	EM
Kim, Byung Chul (Benny)	University of Wollongong	UOW, Australia	SES
Lee , Chong Yong	University of Wollongong	UOW, Australia	EM/SES
Liu , Xiao	University of Wollongong	UOW, Australia	EM/SBS
Nattestad, Andrew	University of Wollongong	UOW, Australia	EM/SES
Sencadas, Vitor	University of Wollongong	UOW, Australia	SR
Zhang, Binbin	University of Wollongong	YNU, Japan	EM/SBS
Oetomo, Denny	University of Wollongong	University of Melbourne, Australia	SR
Zhang, Qingsheng	University of Wollongong	UOW, Australia	SBS
Morrin, Aoife	University of Wollongong	Dublin City University	EM/SBS/EFD
Forster, Robert	University of Wollongong	Dublin City University	EM/SBS
Azofra, Luis	Monash University	Monash, Australia	SES
Bond, Alan	Monash University	Monash, Australia	SES
Sun, Chenghua	Swinburne University	Monash, Australia	SES
Atobe, Mahito	Monash University	Yokohama National University (YNU)	SES
Fukuda, Junji	Monash University	Yokohama National University (YNU)	SES
Hutchison, Katrina	Monash University	Adjunct Monash, Macquarie University	EPPE
Chen, Fangfang	Deakin University	Deakin, Australia	EM/ modelling
Greene, Wren (George)	Deakin University	Deakin, Australia	SBS/EFD
Kerr, Robert	Deakin University	Deakin, Australia	SES
O'Dell, Luke	Deakin University	Deakin, Australia	EM/ characterisation
Zhu, Haijin	Deakin University	Deakin, Australia	EM
Mecerreyes, David	Deakin University	Polymat University of the Basque Country	EM/SES
Rajkhowa, Rangam	Deakin University	Deakin, Australia	EM
Breadmore, Michael	University of Tasmania	UTAS, Australia	EFD
Gilbert, Frederic (DECRA)	University of Tasmania	UTAS, Australia	EPPE
Lewis, Trevor	University of Tasmania	UTAS, Australia	EFD
Nesterenko, Pavel	University of Tasmania	UTAS, Australia	EFD
Neilsen, Jan	University of Tasmania	UTAS, Australia	EPPE
Thickett, Stuart	University of Tasmania	UTAS, Australia	EFD

Name	ACES Node	AI affiliation	Program Theme
Thomson, Colin	University of Tasmania	UOW, Australia	EPPE
Choong, Peter	University of Melbourne, Australia	University of Melbourne, Australia	SBS
DiBella, Claudia	University of Melbourne, Australia	University of Melbourne, Australia	SBS
Duchi, Serena	University of Melbourne, Australia	University of Melbourne, Australia	SBS
McArthur, Sally	Swinburne University of Technology	Swinburne University of Technology	EM/SBS
Stoddard, Paul	Swinburne University of Technology	Swinburne University of Technology	EM/SBS



2018 Activity Plan

GOAL 1: RESEARCH

2018-2020 RESEARCH MILESTONES

Utilise the knowledge gained in fluidics and diagnostics, synthetic energy systems, synthetic biosystems and soft robotics – specifically to:

- Develop devices for CO₂/N₂ reduction
- Develop the 'brain on a bench' system
- Develop a soft robotic hand
- Develop strategies to address ethical, policy and regulatory issues that arise from technical advances in each of these areas

THEMES

ELECTROMATERIALS

Milestone EM7: Identified the most appropriate materials for the application theme projects for Years 5-7.

Milestone EM8: Developed methodology using modelling to interrogate electrolyte structure and double layer behaviour at electrode interfaces.

Milestone EM9: Harnessed electric fields to catalyse a non-electrochemical reaction in solution.

Milestone EM10: Developed and benchmarked methodology for modelling photochemical reactions.

ELECTROFLUIDICS AND DIAGNOSTICS

Milestone EFD4: Fabricated 3D printable analytical platforms with integrated electrodes, porous structures, membranes and microfluidics for electro-

isolation, concentration, separation and detection of target solutes (including environmental monitoring applications, e.g. phosphates, nitrates).

Milestone EFD6: Delivered integrated 3D microfluidic platform for study and monitoring of electro, thermal and optical stimulated controlled delivery of drugs from hydrogels.

SYNTHETIC ENERGY SYSTEMS

Milestone SES4: Developed first stage device prototype designs and initiated construction for:

- A Solar driven CO₂ or N₂ Reduction Cell
- A Sodium-air Battery and
- A Thermoelectrochemical cell

SYNTHETIC BIOSYSTEMS

Milestone SBS4: Finalised 3D Neural Modelling Platform Configuration/ Fabrication Process.

SOFT ROBOTICS FOR PROSTHETIC DEVICES

Milestone SR3: Built a multi-digit 3D robotic prosthetic hand with control system enabling tuneable grip compliance.

ETHICS, POLICY AND PUBLIC ENGAGEMENT

Milestone EPE2: Identified the ethical implications of assumptions about disability therapy and enhancement.

Milestone EPE3: Developed an approach to engagement of key stakeholders in new energy technologies.

GOAL 2: RESEARCH TRAINING

Develop and implement mentoring programs through: (i) the Entrepreneur in Residence program to facilitate research transition to commercial opportunity and (ii) end-user network to assist students formulate translational aspects for their projects.

GOAL 3: TRANSLATION COMMERCIALISATION

END 2018: Develop commercial engagement plans for:

- Soft Robotics
- CO₂/ N₂ reduction
- 3D Bioprinting

GOAL 4: GLOBAL ENGAGEMENT

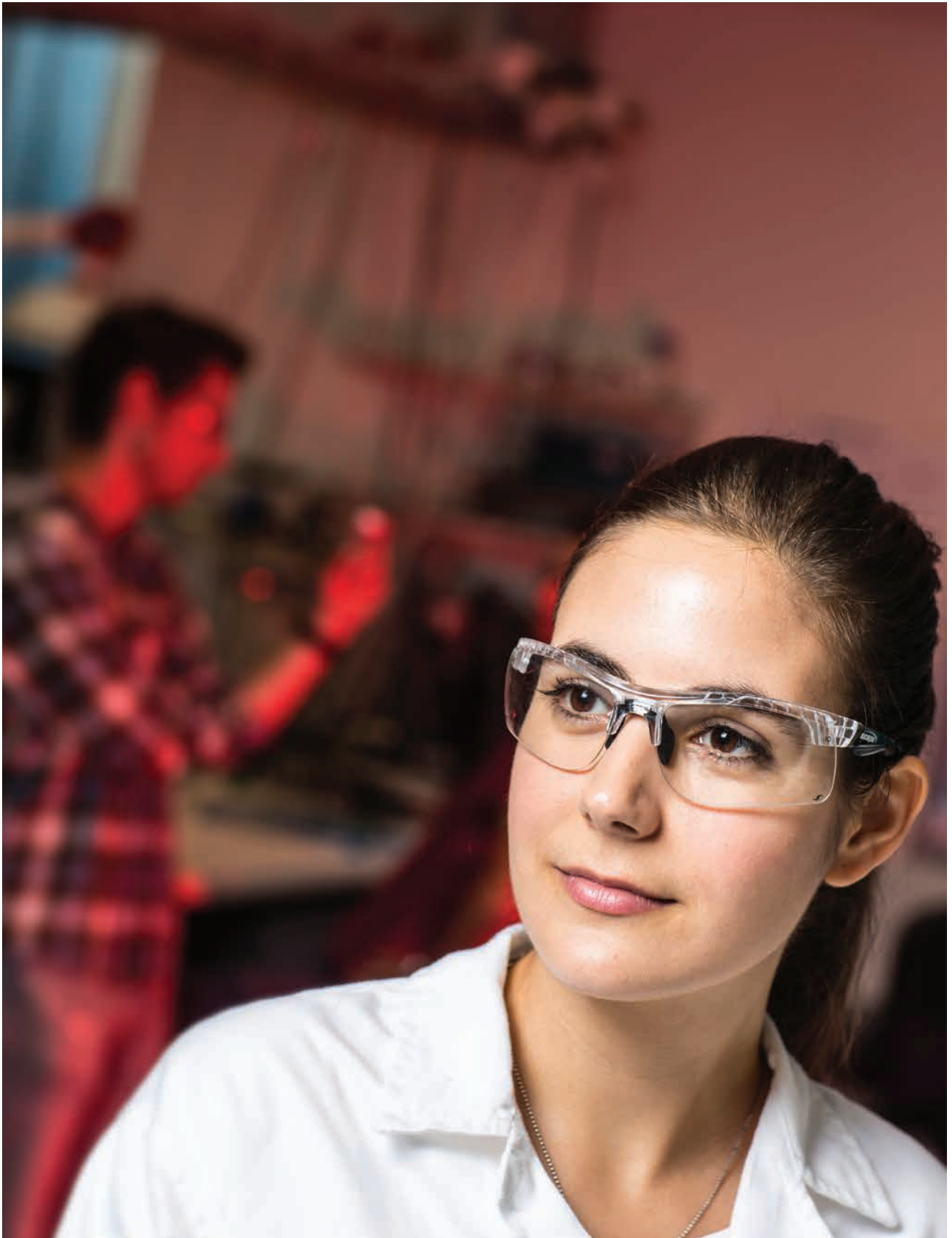
2018-2020: Implement international collaborative research opportunities with the newly established international alliances.

GOAL 5: COMMUNICATIONS

END 2018: Establish plans for new Science Centre exhibits to be implemented in 2019.

ONGOING:

- Host the annual Bill Wheeler Award.
- Host a Science Week event.



Supplementary Information

Appendix 1: ACES Research Training and Mentoring Events 2017

APPENDIX 1: ACES RESEARCH TRAINING AND MENTORING EVENTS 2017		WHEN	WHERE
1.	Introduction to 3D printing Capabilities by ANFF. The ACES-ANFF partnership is critical to translating our research into real-world devices.	20 January	iC campus UOW Wollongong
2.	Round Table Discussion on Bionics: ACES members & ACES AI Prof Fukuda from YNU, Japan	25 January 2017	iC campus UOW Wollongong
3.	ACES-Clinical Connections Workshop: An opportunity for students and ECRs to present and discuss the research with clinical mentors	30 January	Wollongong Private Hospital
4.	ACES Face to Face Theme Meetings: Soft Robotics, Electrofluidics, Ethics, Policy and Public Engagement, Synthetic Biosystems and Synthetic Energy Systems were run for 1-1.5 hours through the course of the day	7 February	iC campus UOW Wollongong
5.	ACES Electromaterials Symposium: Showcase of ACES research and networking event with ACES collaborators	8- 10 February	iC campus UOW Wollongong
6.	ACES Bioprinting Commercialisation Workshop: an internal bioprinting workshop led by Dr Russell Jones, ACES International Advisory Committee member and previous project team leader in new venture commercialisation at GSK.	14 February	iCampus UOW Wollongong
7.	Electrochemistry Workshop	24 February	Monash University Melbourne
8.	Electromaterials Masters course lectures	23, 27-31 March	Virtual- video link
9.	ACES Science Communications Training: Run by Niall Byrne from Science in Public.	27 March & 24 July	Deakin University Melbourne
10.	Establishing Research Networks	11 April	Webinar - virtual
11.	In house ACES SBS face to face meeting: to review progress towards the research milestones and other opportunities.	21 April	iCampus UOW Wollongong
12.	In house ACES GeLMA processing and printing: face to face discussion for users.	24 April	Virtual video link
13.	In house ACES face to face Electrofluidics and Diagnostics Workshop: to review progress towards the research milestones and other opportunities.	1 May	UTAS Tasmania
14.	Battery Workshop at ACES Deakin Dr William Eggers (founder and President of Bio-logic USA) ran a battery workshop with training sessions in the art of performing electrochemistry and electrochemical impedance experiments in various applications.	20 June	Deakin University Melbourne
15.	ACES in house Scientific Writing- Manuscript workshop was given by Dr Kate Nairn.	June	Deakin University Melbourne

APPENDIX 1: ACES RESEARCH TRAINING AND MENTORING EVENTS 2017		WHEN	WHERE
16.	ACES Full Centre Meeting: A review of progress, revise the milestones where needed and conduct research training. This meeting included for research training purposes a session on ACES - Aquahydrex 'Building robust Electrochemical Devices' seminar.	20 July	iCampus UOW Wollongong
17.	RSC Editor Katie Lim Postgraduate Workshop on 'Writing for Chemistry Journals': for post graduate research training and an opportunity for anyone thinking of publishing as a career to talk to an Editor.	21 July	Monash University Melbourne
18.	9th World Congress on Biomimetics, Artificial Muscles and Nano-Bio (BAMN2017): brought together world leading experts to discuss the latest trends, breakthroughs and applications of smart materials for use in soft robotics, biomimetics, medical bionics and wearable technologies.	25- 27 September	iCampus UOW Wollongong
19.	Modelling Building and Interrogating Neural Networks - An ACES event with Professor Jari Hyttinen from Tampere University of Technology in Finland. His research group has worked on the role of astrocytes in neural network formation.	3 October	iCampus UOW Wollongong
20.	In house ACES SBS face to face meeting: to review progress towards the research milestones and other opportunities.	4 October	iCampus UOW Wollongong
21.	Designing for Prototypes Workshop: The aim of this workshop was to look at the design of a prosthetic hand.	9 October	Deakin Warun Ponds Melbourne
22.	ACES- CNBS joint workshop - '3D Printing & Wound Healing': ACES organised a joint workshop with the CBNS ARC Centre of Excellence to identify areas of collaboration and to familiarise the centre researchers with the type of activities going on at the respective centres. The research undertaken by the Centre's ECR and students was the focus for the workshop.	10 October	St Vincent's Hospital Melbourne
23.	BIOFAB masters course lectures: The 3D printing process, Materials for 3D printing, Live Cell printing, Characterisation of Materials and Characterisation of Materials Part 2	12,13,16, 19, 20 October	iCampus UOW Wollongong Melbourne
24.	3D Bioprinting Regulation and Ethics Workshop: Attendees from UOW, UNSW, Monash, the TGA and Anatomics explored the issues around regulation and ethical matters associated with the development and establishment of 3D bioprinting facilities and expertise for clinical treatment and in hospital environments – where our current regulatory framework might not be appropriate. The program included presentations from Prof Sue Dodds (UNSW), Dr Mary Walker (Monash), Robert Thompson (Anatomics) and Dr Elizabeth McGrath (Therapeutic Goods Administration) and group activities discussing ethical scenarios and hypotheticals.	3 November	iCampus UOW Wollongong
25.	Hydrogen Experimental design workshop: a hands on practical workshop run for ACES by Aquahydrex CTO & General Manager Paul Barrett	16 November	Virtual from iC campus
26.	In house ACES Solar fuels workshop: covered topics of CO ₂ , N ₂ and O ₂ electroreduction for the theme members and affiliates.	14 December	Monash University, Melbourne
27.	Patton'd Studios Illustrator and Design Workshop: This pilot workshop was a 'hands on' learning exercise for researchers to build graphics and understand design concepts. In our modern digital world images are more important than ever in being able to understand concepts.	4 & 7 December	Deakin University, Melbourne

APPENDIX 1: ACES RESEARCH TRAINING AND MENTORING EVENTS 2017		WHEN	WHERE
28.	In house ACES Scientific Graphics workshop: run by Dr Kate Nairn as a followup to the Patton'd Studios Illustrator and Design Workshop.	December	Deakin University, Melbourne
29.	ACES- St Vincent's Hospital Melbourne Synthetic Biosystems review workshop for ongoing work into nerve and muscle repair.	19 December	St Vincent's Hospital Melbourne

Appendix 2: End-User And Government Visits To ACES Nodes 2017

APPENDIX 2: END-USER AND GOVERNMENT VISITS TO ACES NODES 2017
<ol style="list-style-type: none"> 1. Austeng members visited ACES Deakin to discuss research on hazards to environment and equipment relating to cremating pacemaker batteries, 12 January. 2. Mr David McMullan and Mr Travis McMaugh from PRP Diagnostic Imaging Shellharbour visited ACES UOW to discuss medical data from imaging on 16 January. 3. Andrew Ross, Bluey Australia, visited ACES UOW to examine facilities and discuss research opportunities, 20 January. 4. Toyota/TEMA held meetings with ACES Deakin to discuss collaborative projects and industry fellowships, 24 January, 16 March, 22 May and 29 August. 5. HydroQuebec and ACES Deakin had a phone meeting to discuss memorandum of understanding so as to progress research opportunities, 3 February. 6. Benjamin Hayes, Department of Defence, held meetings with ACES Deakin to discuss collaborative projects and view the facilities, 6 February. 7. Greg Solomon, Eden Energy, held meetings with ACES Deakin to discuss collaborative projects and view the facilities, 15 February. 8. Wesley Henderson, Army research office, held a phone meeting with CI Howlett, to discuss research opportunities, 15 February. 9. Andrew Jones (CEO) and Dr William Parr (CTO) from 3DMorphic visited ACES UOW to examine and discuss the additive manufacturing capabilities, 17 February. 10. Daniel J Abrams MD from Cerebral Therapeutics visited ACES UOW to examine and discuss the additive manufacturing capabilities, 26-27 February. 11. MTPConnect members Sue McLeman, Dr Sandhya Tewari, Melanie Thomson, Zoe Stephenson and Elizabeth Stares visited ACES UOM at St Vincent's Hospital Melbourne, 1 March. 12. Cameron Ferris, Commercialisation Manager iQnovate, visited ACES UOW for discussions on the ACES technologies, 6 March. 13. Profs Gerog Hajdu, Xiao Fu-composer Hoschs Schule fur Music and Theater Hamburg, Terumi Narushima, Kraig Grady- UOW global challenge researchers visited ACES UOW to discuss manufacturing of 3D printed flutes, 7 March. 14. Tim Gibson Manager Member and Partnership Strategy Advanced Manufacturing Growth Centre, visited ACES UOW for a lab oratory tour and to discuss opportunities in industry led organisations, 9 March. 15. Board Members of St John of God Subiaco Hospital visited ACES UOM at St Vincent's Hospital Melbourne, 9 March. 16. Dr Alfredo Martinez-Coll, General Manager Stakeholder Engagement MTP Connect visited ACES UOW to explore collaboration opportunities, 9 March. 17. Alan Myers, Myers Foundation, visited ACES UOM at St Vincent's Hospital Melbourne, 16 March. 18. Andrew Parre Relationship Manager ANZ Healthcare NSW South Coast visited ACES UOW for business relationship building, 24 March. 19. Mary Wooldridge, Shadow Minister Health Victorian Liberal Party, visited ACES UOM at St Vincent's Hospital Melbourne, 28 March.

APPENDIX 2: END-USER AND GOVERNMENT VISITS TO ACES NODES 2017

20. Dr Youssef Shekibi, Defence Science and Technology Group, and Gautam Sharma, Vista Power, toured facilities at Deakin Burwood and BatTRIhub in Geelong and held discussions around batteries research, 29 March.
21. John Fraser, Secretary Federal Treasury, visited ACES UOM at St Vincent's Hospital Melbourne, 3 April.
22. Philip Sheridan, Principal at Traditional Coatings, visited ACES UOW to discuss printing options and machine recommendations, 4 April.
23. Simon Belcher, Nicholas Dylan and James Nicholson, Motherson Innovations, visited ACES UOW, to review research progress 11 April.
24. Daniel Vladeta CEO Oov Pty Ltd, visited ACES UOW to look at the development of 3D printing material for prototype development and customised products, 12 April.
25. Peter Gillies Director A&I Coatings and Zhara Shahbazian Advantage SME manager ICR UOW visited ACES UOW to review the 3D printing facilities with a view to future collaboration, 13 April.
26. Gusten Danielsson from Cellink was hosted at ACES UOM /St Vincents Hospital Melbourne to discuss available inks and 3D bioprinters, 13 April.
27. Gusten Danielson CFO Cellink Ab visited ACES UOW to discuss research directions, 18 April.
28. Dyoan Thorpe, SMR automotive, ACES UOM /St Vincents Hospital Melbourne to discuss 3D bioprinters, 26 April.
29. David Woodgrove, Entrepreneur, was hosted at ACES Deakin for discussions, 4 May.
30. Medtronic, visited ACES UOW for collaborative research discussions, 3 May.
31. Robert Wilson, Ed Wilson, Mohinder Pannu, Wilson Transformer Company, toured facilities at Deakin Burwood and BatTRIhub in Geelong and held discussions around batteries research, 15 May.
32. 40 delegates from Department of Environmental Land, Water and Planning toured the BatTRIhub facility, 22 May.
33. Michael Ling, Defence Science and Technology Group, visited ACES Deakin for collaborative discussions on robots, 2 June.
34. Denis King (Board member), Margot Mains (Chief executive) and Nick Northcott (Managing Director) Illawarra Shoalhaven Local Health District visited ACES UOW to discuss collaboration opportunities, 5 June.
35. David Crowe (CEO) and Elise Piucco (Commercial Manager), Ramsay Health, Wollongong Private Hospital visited ACES UOW to discuss 3D printing and the relationship with Ramsay Health Care, 8 June.
36. Malcolm Roberston, Geoff, Robert, OneSteel representatives, visited ACES Deakin for progress of collaborative project, 8 June, 28 August, 7 November.
37. Airbus visited ACES Deakin Warun Ponds, BatTRIhub, with CI Howlett, to discuss research collaborations, 14 June.
38. Peter Ralbovsky and Andrew Gillen, Netzsch, visited ACES Deakin Warun Ponds, BatTRIhub, with CI Howlett, to discuss research collaborations in the area of thermal analysis techniques for battery material development and testing, 14 June.
39. Michael Ling, DSTO, visited ACES Deakin for research discussions, 15 June.
40. Ralph, N (2017) ACES Deakin RF visited the Elwood Community Centre to learn about Indian businessman, Adani and his Carmichael mine in Queensland and the potential social/environmental issues of continuing with fossil fuel energy, 16 June.
41. Dr Bill Eggers and Vince Stafrace, ProDigitek, visited ACES Deakin to discuss battery technologies, 20 June.
42. Charne Esterhuizen MAAK Clothing and Zhara Shahbazian Advantage SME manager ICR UOW visited ACES UOW to review the 3D printing facilities and their role in future fashion opportunities, 29 June.
43. Mark Adams (Director) and David Liuwantara (Consultant) Australian Biosearch, visited ACES UOW to review the facilities and research activities, 4 July.
44. Mr Wade Blazley, Director Research and Development, Solafast for solar cell discussions, ACES at UOW, 6 July.
45. Mr Barry Holcombe, former CSIRO textile expert visited ACES at UOW, 7 July.

APPENDIX 2: END-USER AND GOVERNMENT VISITS TO ACES NODES 2017

46. Evan McKay (Sales Manager), Dale Kirkwood (General Manager) and Garry Jones (Consultant) Impreglon Australia visited ACES UOW to review the facilities and discuss the research, 10 July.
47. Stuart Creal, Director Wollongong Science Centre, visited ACES UOW 10 July.
48. Evan McKay, Garry Jones & Dale Kirkwood from Impreglon Australia Pty Ltd, visited ACES UOW, 11 July.
49. Applied Nanotechnologies P/L industry group visit to ACES Monash for collaborative discussion, July.
50. Gil Styne, Plastic Surgeon, visited ACES UOW for collaborative research discussion, 17 July and 28 September.
51. Dianne Smith (Exec Director Melbourne Chamber of Commerce) and Julia L Page (CEO, Veski) toured the ACES facilities UOM/St Vincents Hospital Melbourne, 26 July.
52. Prof Gerard Sutton, Surgeon, visited ACES UOW for collaborative research discussions re the iFix pen, 27 July.
53. Craig Guscott, Service and Capital Planning in DHHS, toured the ACES facilities UOM/St Vincents Hospital Melbourne, 4 August.
54. Seyed Miri, Airbus, visited ACES Deakin, with CI Howlett and CI Forsyth, to tour the facilities and discuss research collaborations, 10 August.
55. Calix batteries, visited ACES Deakin for initial discussions on possible collaborative research, 17 August.
56. Four representatives from Daronmont visited ACES Deakin to tour the facilities and discuss research collaborations, 24 August.
57. Deb Lau, Adam Best, Leon Prentice, CSIRO, visited ACES Deakin to discuss progress of research collaborations, 25 August.
58. Calix batteries, visited ACES Monash for further research discussions, 5 September.
59. Lynne Bilston, NueRA visited ACES at UOW to discuss collaborative research projects, 8 September.
60. Deb Lau, Adam Best, Leon Prentice, CSIRO, visited ACES Deakin to discuss progress of research collaborations, 25 August.
61. Caroline Funnell, Respiratory Nurse, Laura Campbell, Respiratory Nurse with Comprehensive Care visited ACES at UOW to review capabilities of 3D printing, 8 September.
62. Elane Zelcer and Stephen Goodall, Accelerating Commercialisation AusTrade and Industry, toured the ACES facilities UOM/St Vincents Hospital Melbourne, 10 September.
63. Alan Finkel, Office of the Chief Scientist,
64. Neil Wilson, ROMAR Engineering, visited ACES UOW for collaborative research discussion, 13 September.
65. Tracy Pascoe, Destination Wollongong, visited ACES UOW to talk about event and tourism opportunities, 20 September.
66. Andrew Batty, Lincoln Consulting Group, visited ACES UOW to review ACES technologies, 21 September.
67. Renewable Hydrogen industry group visit to ACES Monash for collaborative discussion, September.
68. Commercialisation advisors Elane Zelcer and Stephen Goodall visited ACES UOW RF Anita Quigley and the BioFab3D at St Vincent's Hospital Melbourne, 9 October.
69. Pia Winberg, Venus Shell Systems, and guest, hosted at ACES UOW for research discussions, 11 October.
70. Paul Barrett, Aquahydrex, visited ACES UOW for research discussions, 12 October.
71. Frederic Gilbert had meeting with the CEO of Cerebral Therapeutics for inclusion of an ethics project within their first-in-human clinical trial testing a drug delivery system targeting epilepsy (ClinicalTrials.gov identifier NCT02899611), 16 October.
72. Ms Leyla Zaker-Tabrizi Account Manager and Nishen Naidoo, Application specialist Bio-Rad P/L visited ACES at UOW to give a workshop and product demonstration, 24-25 October.
73. Phil Davies Trade Victoria and a Taiwanese government and senior academic scientists delegation toured the ACES facilities UOM/St Vincent's Hospital Melbourne, 127 October.
74. CALIX Ltd industry group visit to ACES Monash for collaborative discussion, October.
75. Bosch industry group visit to ACES Monash for collaborative discussion, October.
76. Simon Belcher, Motherson Innovations, visited ACES UOW, 6 November.



APPENDIX 2: END-USER AND GOVERNMENT VISITS TO ACES NODES 2017

77. Evan Evans, formerly Bluescope Steel, visited ACES UOW to discuss possible collaborative projects, 27 September and 8 November.
78. Boron Molecular visited ACES Deakin at Burwood for collaborative research discussions, 9 November.
79. William Verity, Fairfax media, visited ACES UOW to see the facilities and research activities, 10 November.
80. Amy Sherden from ABC visited ACES UOW to film and get information on the research about the brain on the bench, and the cartilage project looking to build a living ear with a view to reporting on the research, 13 November.
81. Robbie Chiu, Manager of Strategic Project Delivery, Industry Development NSW Department of Industry visited ACES at UOW to review the research activities and discuss program initiatives, 16 November.
82. Jinhong Kim (President), Sanghyun Yu (Manager), Jungyoub Lee (Researcher) from Education Facility Disaster Association visited ACES at UOW to discuss safety management of this University facility, 20 November.
83. Ionic Industries P/L industry group visit to ACES Monash for collaborative discussion, November.
84. IPGroup industry group visit to ACES Monash for collaborative discussion, November.
85. Dr John Sinn, Staff Specialist Allergist and Neonatologist at Royal North Shore Hospital visited ACES at UOW to discuss what technologies can be developed for desensitization and slow release nanotechnologies, 5 December.
86. Milind Raje, Cochlear, visited ACES UOW to discuss project plans, 12 December.

Appendix 3: ACES members visiting government, industry in 2017

APPENDIX 3: ACES MEMBERS VISITING GOVERNMENT, INDUSTRY IN 2017

1. Officer, D. L. (2017) ACES CI UOW research discussion with Mr Richard Hunter, CEO, Screen Sign Arts, Christchurch, New Zealand, 10 January.
2. Hancock, L (2017) ACES CI Deakin visited Rijit Sengupta, CEO Centre for Responsible Business, New Delhi, India, 30 March and 20 November.
3. Officer, D. L. (2017) ACES CI UOW research project discussions with iGlass, Ballarat, Victoria, Australia, 20 January.
4. Howlett, P (2017) ACES CI Deakin met with Airbus at the Avalon Airshow for research discussions, 1 March.
5. MacFarlane D (2017) ACES CI Monash attended the Ammonia Fuel Association - Australian Chapter's inaugural meeting May and end of year meeting November
6. Hancock, L (2017) ACES CI Deakin visited Sr Javier Moeller, Director External Commerce Dutch-Bolivian Chamber of Commerce and Industry, La Paz, Bolivia, 1 June.
7. Hancock, L (2017) ACES CI Deakin visited Sr Adrian Samfest, German Embassy, La Paz, Bolivia, 2 June.
8. Hancock L, Ralph N (2017) ACES CI and RF Deakin visited the University of Melbourne & Melbourne Energy Institute to attend a panel discussion on 'Energy Futures - Chief Scientist Alan Finkel's review of the security of electricity', with Alan Finkel, Audrey Zibelman, CEO of Australian Energy Market Operator; Tony Wood, Energy Program Director at Grattan Institute, 22 June 2017.
9. MacFarlane, D (2017) ACES CI Monash visited Siemens, Erlangen, Germany June
10. Taylor, Adam (2017) invited talk at PacPrint 2017 "Applications of 3D Printing: The Jeweller, Plumber, Musician, Surfer and Clinician". ACES-ANFF demonstration booth was present all week, 23-26 May.
11. MacFarlane, D (2017) ACES CI Monash visited Yara International, Oslo, July
12. MacFarlane, D (2017) ACES CI Monash visited 7IPGroup, London, September
13. Xiao, Liu (2017) ACES RF UOW visited Cochlear Sydney for discussion research proposal, 25 September
14. Gilbert, F (2017) ACES AI UTAS had meeting with CEO of company Cerebral Therapeutics for inclusion of an ethics project within their first-in-human clinical trial testing a drug delivery system targeting epilepsy (ADDRESS trial -ClinicalTrials.gov Identifier NCT02899611), 16 October.
15. Ralph, N (2017) ACES RF Deakin held a phone meeting with Greg Hannann (Ausnet Services and former advisor to Victorian Premier to Discuss gas/electricity sector's needs and future) to discuss the Liberal party perception on manufacturing of alternative energy technologies, 18 October.
16. Walker, M (2017) ACES RF Monash met with Darrel Sparke from Amputees NSW to discuss progress of the ACES survey and to review other opportunities for collaboration, 1 November.
17. Wallace, G (2017) as a NSW business ambassador attended the Business Events Sydney Ambassador Dinner, Sydney, 1 November.
18. Walker M, (2017) ACES RF Monash visited Limbs 4 Life Inc offices, Mount Waverley and met with CEO Melissa Noonan to discuss ethical issues around prosthetic provision in Australia, 2017.
19. Hancock, L (2017) ACES CI Deakin visited Sapna Naruta, Department of Business and Sustainability, TERI, New Delhi, 17 November.
20. Hancock, L (2017) ACES CI Deakin visited Paranjay Thakurta, Habitat Centre New Delhi, 17 November.
21. Hancock, L (2017) ACES CI Deakin visited Bimal Arora, Aston School of Business and Centre for Responsible Business, New Delhi, India, 21 November.
22. Hancock, L (2017) ACES CI Deakin visited Sanjay Kumar, Indian Railways sustainable supply chain, New Delhi, 22 November.
23. Hancock, L (2017) ACES CI Deakin met with Prof Johanna Hoffken of School of Innovations Sciences, University of Technology Eindhoven, Netherlands and Evan Mertens, founding Director Rural Spark (solar start-up), New Delhi, India, 23 November.

APPENDIX 3: ACES MEMBERS VISITING GOVERNMENT, INDUSTRY IN 2017

24. Gilbert, F (2017) ACES AI UTAS was solicited by Medtronic, with respect to FDA compliances, to provide further information about data published in Gilbert (2017) Deep Brain Stimulation: Inducing Self Estrangement, Neuroethics, DOI: 10.1007/s12152-017-9334-7.
25. Officer, DL (2017) ACES CI UOW research visit Centre for Organic Electronics to discuss future electrochromic project with Mr Johnny Pak (CEO, iGlass) and Prof Paul Dastoor, University of Newcastle, Newcastle, Australia, 11 December.
26. Howlett, P (2017) ACES CI Deakin visited Toyota in Japan for research discussions, December.

Appendix 4: ACES End-User Events 2017

Appendix 4: ACES End-User Events 2017		WHEN	WHERE
1.	Introduction to 3D printing Capabilities by ANFF: The ACES-ANFF partnership is critical to translating our research into real-world devices.	20 January	iCampus UOW Wollongong
2.	ACES Bioprinting Commercialisation Workshop: an internal bioprinting workshop led by Dr Russell Jones, ACES International Advisory Committee member and previous project team leader in new venture commercialisation at GSK.	14 February	iCampus UOW Wollongong
3.	UAE–Australia Healthcare Research Symposium: In its fifth year, Australia Unlimited MENA 2017 has an overarching theme of 'Collaborate to Innovate' and will involve participants with expertise in healthcare research, food and agriculture and the mining sector. ACES Director Prof G Wallace was an invited panel member for "Commercialising Innovation: Australian healthcare technologies".	13 March	Dubai
4.	3D Bioprinting workshop at the UOW Dubai campus: Austrade, in collaboration with UOWD, extended invitations to key healthcare customers. The preceding day Prof Wallace was a guest at the Gulf Medical University (GMU) where he had a meeting with healthcare authority followed by visit to the UAE University to meet senior dignitaries and visit the innovation centre.	15 March	UOW Dubai campus
5.	Korean ACES Research Showcase: was held at the Australian Embassy in Korea. Representatives from Hanyang University, Gangneung Wonju National University, KIMM, Dongguk University, Seoul National University, Konyang University, Jeju National University, National Research Foundation of Korea, KIST, Yonsei University College of Medicine, ASAN medical centre, Digital Times, The Electronic Times, LG Chem, Samusung SDI, Korea Biotechnology Industry Organization, InfoPia, Bit Computer, I-Sens, Auto Industrial and Samsung electronics were in attendance.	20 April	Seoul Korea
6.	ACES-ANFF at PacPrint2017 and invited talk "Applications of 3D Printing: The Jeweller, Plumber, Musician, Surfer and Clinician" by Adam Taylor (Fabrication Technician ACES) in addition to ACES-ANFF exhibition stall. At the PacPrint in Melbourne many exhibitors present the worldwide newest and most innovative technologies in the fields of printing and graphic communication. It takes place every four years and one of the largest and most important trade fairs for the industry in the southern hemisphere. The key industry players together in one place have the opportunity to communicate with colleagues, customers, competitors and potential customers.	23-26 May	Melbourne

Appendix 4: ACES End-User Events 2017		WHEN	WHERE
7.	'Bioprinting in Surgery' evening: hosted by ACES- Institute of Academic Surgery- RPA Transplant Institute. Prof Gordon Wallace AO spoke about 'Tissue Regeneration and 3D Printing: A Clinical Focus' and A/Prof Payal Mukherjee on 'Bioprinting in ENT: What is happening locally? Can we scale infrastructure to other specialties?' ACES researchers were on hand scanning and printing artificial ears.	28 August	Royal Prince Alfred Hospital Sydney
8.	ANFF Directors meeting: An opportunity for the ANFF members to tour the ACES-ANFF facilities at Wollongong	4 October	iCampus UOW Wollongong
9.	NSW Health Innovation Symposium 'Our Health Story Our Health Future': Director Gordon Wallace was an invited speaker.	26-27 October	Sydney
10.	Light-Sheet Microscopy and Neural Modelling Workshop: the aim was to prepare a Neuromuscular Regenerative Research Prospectus.	27 November	St Vincent's Hospital Melbourne

Appendix 5: 23 Plenary/Keynote Addresses given by ACES members

APPENDIX 5: PLENARY/KEYNOTE ADDRESSES GIVEN BY ACES MEMBERS	
1.	MacFarlane (2017) 'Protic Ionic Liquids for CO ₂ Capture' at the 3rd International Conference on Ionic Liquids in Separation and Purification Technology, Kuala Lumpur, 8-11 January.
2.	Kerr, R. (2017) 'Energy Storage Beyond Li-ion - New Developments in Electrolytes Enabling Li and Na metal devices at Clean Energy Forum', Perth, 2-6 February.
3.	MacFarlane, D (2017) 'Energy Applications of Ionic Liquids – From Global Perspectives to Computational Approaches' at the Solvay Symposium on Ionic Liquids, Brussels, 20-24 February.
4.	Forsyth, M. (2017) 'Ultra-high salt concentration electrolytes – the key to enabling high energy density anodes for beyond Li-ion batteries' at IBA17 Conference, Japan, 5-12 March.
5.	Officer, D. L. (2017) 'Communication with Neurons – New Materials and New Dimensions', 2017 Materials Research Society (MRS) Spring Meeting and Exhibit, Phoenix, USA, 17-21 April.
6.	Wallace, GG (2017) 'Communication with Neurons - New Materials and New Dimensions', 25th Annual Australasian Society for Biomaterials and Tissue Engineering Conference, Canberra, Australia, 18-20 April.
7.	Hancock, L (2017) 'Bolivia's Lithium Frontier: Can Cleaner Technologies Harness a Mineral Development Boom?' paper delivered to the Sixth International Workshop: Advances in Cleaner Production, Brazil, 24-26 May.
8.	Wallace, G. (2015) Organic Bionics: The Need for 3D Printing at 4th International Conference "Strategies in Tissue Engineering", Wurzburg, Germany, 10-12 June.
9.	Wallace, G (2017) 'Communication with neurons – new materials and new dimensions' at European Medical and Biological Engineering Conference (EMBEC) and Nordic-Baltic Conference on Biomedical Engineering and Medical Physics (NBC) in Tampere, Finland, 11-15 June.
10.	Coote, M (2017) 'pH-Switchable Electrostatic Catalysis' at the RACI National Centenary Chemistry Conference, Melbourne, 23-28 July.
11.	Wallace, G (2017) 'Communication with neurons – new materials and new dimensions' at RACI Centenary Congress 2017, Melbourne Australia, 23-28 July.
12.	Bourke, J (2017) 'Innovations in Personalised Medicine: Electrophysiology for Epilepsy and Prosthetic Limbs', HELP2017 conference, Ronald McDonald House Charities, Sydney 4-5 September.

APPENDIX 5: PLENARY/KEYNOTE ADDRESSES GIVEN BY ACES MEMBERS	
13.	MacFarlane, D (2017) 'New Dimensions in Salt - Molecular Liquid Mixtures: A 4th Evolution of Ionic Liquids' at the Faraday Discussion, Cambridge, 12-15 September.
14.	Coote, M (2017) 'Electrostatic Catalysis of Non-Redox Reactions' at the 2017 International Conference on BioNano Innovation, Brisbane, 24-27 September.
15.	MacFarlane, D (2017) 'Progress Towards Renewable Energy Storage as Hydrogen and Ammonia' at the Symposium on Energy Technology, Hefei China, 6-7 October.
16.	MacFarlane, D (2017) 'Renewable Energy Storage as Hydrogen and Ammonia' at Chem Commun Symposia on Energy, Beijing, Tianjin and Dalian, 9-13 October.
17.	Bourke J, Wallace G (2017) 'Can we print 3D neuronal networks?' at BITS: Brain Inspired Technologies and Systems, RMIT University, Melbourne, 27 October.
18.	Forsyth, M. (2017) 'Chemical control of reactive interfaces for increased sustainability' at the Annual Surface and Materials Chemistry Symposium, Stockholm, Sweden, 24-26 October
19.	Forsyth, M. (2017) 'Controlling Corrosion with Chemistry Abstract Corrosion is a chemical process' at Australasian Corrosion Association Annual Conference, Sydney, 12-15 November.
20.	Hancock, L (2017) 'New governance models for developing country transitions to renewable energy' at India and Sustainability Standards, New Delhi, 15 November.
21.	Wallace, GG (2017) 'Additive Biofabrication for Medical Applications and Explorations', 3D Printing in Medicine Summer Course, Christchurch, New Zealand, 20-22 November.
22.	Crook JM (2017) 'Bioengineering 3D Models of the Brain' at the 3rd Mathematical Modelling in Biology and Medicine Workshop, University of Wollongong, 24 November.
23.	Wallace, GG (2017) 'Customising 3D Bioprinting for Clinical Applications' 1st Asia-Pacific International Conference on Additive Manufacturing (APICAM2017), RMIT, Melbourne, 4-6 December.

Appendix 6: 84 Invited Talks by ACES members

APPENDIX 6: INVITED TALKS/PANELS GIVEN BY ACES MEMBERS	
1.	Cook, M. (2017) 'Modelling Neural Systems in Epilepsy' at the North American Neuromodulation Society (NANS) 20th Annual Meeting, Las Vegas US, 20 January.
2.	Cook, M. (2017) 'The Dynamics of Seizure Onset and Offset' at the Acquired Epileptogenesis Symposium, Melbourne, Australia, 6 February.
3.	Forsyth M. (2017) Novel Solid Electrolyte materials enabling Li and Na metal devices at the 6th International Conference on Functional Electroceramics and Polymers, India, 20-22 February.
4.	Hancock L and Ralph N (2017) 'Big Energy and the Political Economy of Energy Policy in Australia: Future High Voltage Superpower or Backwater State?' at the International Studies Association (ISA) 'Understanding Change in World Politics', 58th Annual Convention, Baltimore, United States, 22-25 February.
5.	Wang X (2017) 'Collaboration and Translation in Fibre Innovation', UA Higher Education Conference - Research Collaboration & Translation, Canberra, 2 March.*Open to Public
6.	Wallace, G.G. (2017) 'Collaborate to Innovate', Innovation in Manufacturing Breakfast Event, Menai, Australia, 21 March. *Open to Businesses
7.	Sparrow, R (2017) Panelist 'Frankenstein anxiety' at the World Science Festival, Brisbane, 23 March.

APPENDIX 6: INVITED TALKS/PANELS GIVEN BY ACES MEMBERS	
8.	Goddard E (2017) Invited panelist for Emerging Technologies: Critical Engagement and Ethics, Critical Connections: Art, Design & STEM Symposium, Queensland University of Technology, 25 March http://www.thecube.qut.edu.au/education/2017/critical-connections.php
9.	Howlett, P. C. (2017) Deakin/CSIRO: latest developments in battery materials and BatTRI-Hub at Electric Vehicles Conference, Waurn Ponds, Australia, 29 March.
10.	Sparrow R. (2017) Panelist, "Will my robot love me back?" Future Forum, Australian Centre for the Moving Image, 30 March. *Open to the public. https://www.acmi.net.au/events/futures-forum-will-my-robot-love-me-back/
11.	Officer, D. L. (2017) 'Scalable graphene chemistries for processing and fabrication', 2017 International Forum on Graphene, Shenzhen, China, 9-12 April.
12.	Tomaskovic-Crook E, Zhang B, Gu Q, Wallace GG, Crook JM (2017) 'Gelatin Methacrylate for Defined Induction of Brain Organoids from Human Induced Pluripotent Stem Cells: Towards 3d Modelling Of Neural Development, Disease and Regenerative Medicine' at the 25th Annual Conference Australasian Society for Biomaterials and Tissue Engineering (ASBTE), Canberra, 18-20 April.
13.	Quigley A, Kita M, Bourke J, Sweerts K, Crook JM, Wallace GG, Kapsa RMI (2017) Skeletal Muscle Progenitor Delivery by Trojan Hydrogel Fibers at the 25th Annual Conference Australasian Society for Biomaterials and Tissue Engineering (ASBTE), Canberra, 18-20 April.
14.	Walker M, Rogers W (2017) 'Precising definitions as a way to combat overdiagnosis' given at 'Too Much Medicine: Exploring the relevance of philosophy of medicine to medical research and practice', Oxford, UK, 19-20 April.
15.	Wallace, GG (2017) 'Collaborative Links: The Key to 3D Bioprinting', 3D Bioprinting An Australia-Korea Research Partnership, Australian Embassy Republic of Korea, 20 April.
16.	Dodds, S (2017) 'How 3D Bioprinting can Challenge and Enhance Research Ethics', invited presentation as part of the ACES-AMC joint workshop: Printing Parts for Bodies Symposium, Seoul 20 April. ACES with Partner Hanyang University organised this event.
17.	Officer, D. L. (2017) 'Moving microdroplets in 3D using photochemopropulsion', 4th European Chemistry Congress, Barcelona, Spain, 11-13 May.
18.	Wang X (2017) 'Do we really know the thermal properties of fibres', Textile Bioengineering and Informatics (TBIS 2017), Wuhan, 16 -19 May.
19.	Officer, D. L. (2017) Alternative Solar Cell Technology - Dye Sensitised Solar Cells, Pacprint 2017, Innovation Campus, Wollongong, Australia, 23 May. *Open to the public.
20.	Officer, D. L. (2017) Alternative Solar Cell Technology - Dye Sensitised Solar Cells, Pacprint 2017, Innovation Campus, Wollongong, Australia, 24 May. *Open to the public.
21.	Hancock L, Ralph N, Ali SH (2017) presented the paper 'Bolivia's Lithium Frontier: Can Cleaner Technologies Harness a Mineral Development Boom?' at the Sixth International Workshop: Advances in Cleaner Production held in Brazil, 24-26 May.
22.	Tomaskovic-Crook E, Zhang B, Gu Q, Wallace GG, Crook JM (2017) Building brain-organoids through 3D bioprinting: Towards 3D Modelling of Neural Development, Disease and Regenerative Medicine at the 10th Annual Meeting Australian Society of Stem Cell Research (ASSCR), Sydney, 24-26 May.
23.	Moulton S (2017) 'Biofabrication for Drug Delivery', Australia's MedTech Conference & International Conference of Mechanics in Biology and Medicine, Melbourne, 24-25 May.
24.	Wallace, GG (2017) 'Collaborate and Celebrate', Technical Symposium, Dublin City University, Ireland, 25 May.
25.	Wallace, GG (2017) 'Beyond Bionics' Australian Embassy ACES Event, Dublin, Ireland, 25 May.

APPENDIX 6: INVITED TALKS/PANELS GIVEN BY ACES MEMBERS	
26.	Wang, X (2017) 'Advanced Fibre and Textile Materials Research in Australia', AUTEX Conference, Corfu, Greece, 29-30 May.
27.	Wallace, GG (2017) 'Wearables, Implantables and the Brain on a Bench (Beyond Bionics)', Vivid event, Powerhouse Museum, Sydney, 8 June. *Open to Public
28.	Coote, M (2017) 'Stereocontrolled Radical Polymerisation: Are we there yet?' at the Soft Matter Materials Symposium, Brisbane, 8-9 June.
29.	Coote, M (2017) 'Challenges for Modelling Electrostatic Catalysis' at the International Conference Challenges in Computational Homogeneous Catalysis – 2017, Näsby Slott, Stockholm, Sweden, 15-16 June.
30.	Forsyth, M. (2017) 'Superconcentrated ionic liquid electrolytes and their composites: Enabling high specific capacity anodes for Lithium and Sodium batteries' at the 21st International Conference on Solid State Ionics, Padua, Italy, 18-23 June.
31.	Howlett, P. C. (2017) 'Salt based solid-state composite electrolytes: Addition of nanomaterials and the role of Alkali salt concentration' at the 21st International Conference on Solid State Ionics, Padua, Italy, 18-23 June.
32.	Crook JM (2017) Stem Cell Banking Protocols. Global Alliance for iPSC Therapy and International Stem Cell Banking Workshop, Harvard Stem Cell Institute, Boston, USA, 18 June.
33.	Gilbert F. (2017) 'The Putative Effects of Brain Computer Interfaces on Identity: Being Kept in the Loop' to the International Neuroethics Network, Paris, France, 19-21 June.
34.	Coote, M.L. (2017) 'The fate of the Peroxyl radical in Autoxidation' at the 2nd International Conference on Hydrogen Atom Transfer (iCHAT 2017) ", Villa Mondragone, Rome, Italy, 2-6 July.
35.	Howlett, P. C. (2017) Organic Ionic Plastic Crystals – Novel Ionic Electrolytes for Alkali Metal Batteries at Power Our Future, Vitoria, Spain, 2-5 July.
36.	Higgins, M (2017) '"Watching" Kinetics of Single Protein Interactions on Rough Polymer Surfaces using High-Speed Atomic Force Microscopy' at 8th International nanomedicine conference, Coogee, Sydney 3-5 July.
37.	Wallace, G (2017) 'Overview of 3D bioprinting activities' Inaugural Corneal Bioengineering Working Group, Sydney Eye Hospital, Australia, 6 July.
38.	Wallace, G (2017) '3D Bioprinting: Printing Parts for Bodies' 2017 Joint ATSE /Royal Society of Victoria Lecture, Melbourne, Australia, 13 July. *Open to the public?
39.	Forsyth, M. (2017) 'Ion structure and transport in ionic liquid electrolytes; the effect of ultra-high concentration of alkali metal salts on decoupling of Li ⁺ /Na ⁺ conduction' at the 8th International Discussion Meeting on Relaxations in Complex Systems, Wista, Poland, 23-28 July.
40.	Coote, M (2017) 'pH-Switchable Electrostatic Catalysis", Organic Chemistry Program, Physical Organic & Materials Chemistry, at RACI Centenary Congress 2017, Melbourne Australia, 23-28 July.
41.	Officer, D. L., Xiao, Y., Zarghami, S., Wagner, P., Wagner, K. (2017) 3D Light-controlled movement of microdroplets, Royal Australian Chemical Institute (RACI) Centenary Congress 2017, Melbourne, Australia, 23-28 July.
42.	Wagner, K., Hobbs, C., Roach, N., Mitchell, R., Wagner, P., Barnsley, J. E., Gordon, K. C., Kodali, G., Moser, C., Dutton P. L., Officer, D. L (2017) Porphyrin protein maquette-based reaction centres and their application in photovoltaic devices, Royal Australian Chemical Institute (RACI) Centenary Congress 2017, Melbourne, Australia, 23-28 July.
43.	Bonke, S. A.; Tech, M.; Bond, A. M.; Aziz, E. F.; Lange, K. M.; Spiccia, L.; Simonov, A. N. (2017) 'Understanding the mechanism of electrocatalytic water oxidation: an integrated kinetic and spectroscopic approach' at the 6th Asian Conference on Coordination Chemistry, Melbourne, 24 July.
44.	Pringle, J. M. (2017) 'Harvesting thermal energy using redox-active electrolytes' at the 2017 International Symposium on Energy Conversion and Storage Materials, Brisbane, Australia, 31 July-3 August.

APPENDIX 6: INVITED TALKS/PANELS GIVEN BY ACES MEMBERS	
45.	Howlett, P. C. (2017) 'Novel Salt based Electrolyte materials enabling Li and Na Metal devices' at the International Symposium on Energy Conversion and Storage Materials, Brisbane, Australia, 31 July-3 August.
46.	Officer, D. L. (2017) 'Porphyrins as Light Harvesters and Catalysts for Energy Conversion', The Catalyst and Catalysis Forum 2017 (CCF2017), Gold Coast, Australia, 4-5 August.
47.	Wallace, G (2017) 'Biomaterial Background & Future Applications' DDU17 meeting - New Technologies and New Techniques, Sydney, Australia, 4-5 August.
48.	Wallace, GG (2017) Invited panel member for 'Is the current Australian custom-made medical devices regulatory pathway commensurate with the level of risk of 3D printed implantable medical devices?' at the TGA workshop 'Regulatory considerations for additive manufacturing (3D printing) of medical devices', 10 August.
49.	Wallace, GG (2017) 'Biopolymers Making Better Humans' Academy of Science, Plastic Fantastic "Making Better Humans" event, Wollongong, 17 August*Open to Public
50.	in het Panhuis M (2017) '3D and 4D printing of hydrogel materials', American Chemical Society Fall Meeting in Washington D.C., USA, 21 August.
51.	Cook, M. (2017) Long-Term Ambulatory Monitoring: Insights and Opportunities, ICTALS 2017, Minnesota US, 22 August.
52.	Coote, M (2017) 'Ionic auxiliaries for stereocontrolled radical polymerization' at the Controlled Radical Polymerization Symposium of the 254th ACS National Meeting and Exposition, Washington DC, USA, 20-24 August.
53.	Coote, M.L. (2017) 'Directionality and the Role of Polarization in Electrostatic Catalysis' at 11th Triennial Congress of the World Association of Theoretical and Computational Chemistry WATOC, Munich, Germany, 27 August -1 September.
54.	Pozo-Gonzalo, C (2017) 'Oxygen Reduction Mechanism in a Highly Na ⁺ Concentrated Pyrrolidinium-based Ionic Liquid' at 68th Annual Meeting of the International Society of Electrochemistry, Providence, Rhode Island, USA, 27 August - 1 September.
55.	Cook, M. (2017) Experience from invasive EEG based seizure detection, 32nd International Epilepsy Congress, Barcelona Spain, 4 September.
56.	Officer, D. L. (2017) 'Facilitating Communication With Excitable Cells – New Materials and New Dimensions', The 2017 International Conference on Flexible and Printed Electronics (ICFPE2017), Jeju Island, Korea, 5-6 September.
57.	Wang X (2017) 'Fibre to Fabric Innovations in Australia', ITMF Annual Conference, Bali, Indonesia, 14 September.
58.	Gilbert F. (2017) 'Brain Computer Interface: Exploring Estrangement and Embodiment' at Neuroscience and Society meeting, Sydney, 14-15 September.
59.	Ralph, N., Hancock, L. & Macfarlane, D. (2017) 'Can Australia Become an Alternative Energy Superpower? Political Economy and International Relations Impacts of Australia's Potential Alternative Energy Exports to Asia'. Paper presented at the 'Democracy and Populism: A New Age of Extremes?' conference, Australian Political Studies Association, Melbourne, 25-27 September.
60.	Alici, G (2017) 'Soft Robotics: are we on the brink of a new paradigm shift in robotics?' at BAMN 2017, Wollongong, 25-27 September.
61.	Spinks G.M. (2017) 'Effect of Stretch on Artificial Muscles' at BAMN2017: Biomimetics, Artificial Muscles and Nano-Bio, Wollongong, 25-27 September.
62.	Wang X (2017) 'Upgrading of Fibre and Textile Research from Laboratory to Industry' at the 8th International Conference of the Textile Research Division, Cairo, 25-27 September.
63.	Coote, M.L. (2017) 'Revising the Mechanism of Polymer Autoxidation' at the 4th Australia-China Polymer Meeting (CAPM4), Brisbane, Australia, 28-29 September.

APPENDIX 6: INVITED TALKS/PANELS GIVEN BY ACES MEMBERS	
64.	Wallace, GG (2017) 'Biopolymers Making Better Humans' Academy of Science, Plastic Fantastic "Making Better Humans" event, Brisbane, 5 October *Open to Public
65.	Wallace, GG (2017) '3D Printing Overview', 2017 Australia-Taiwan Joint Workshop on 3D Bioprint, National Chiao Tung University, Hsinchu City, Taiwan, 18 October.
66.	Wallace, GG (2017) '3D Printing at ACES: An Overview', Symposium on Advanced Materials and 3D Printing for Biomedical Applications, Shinshu University, Japan, 20 October.
67.	Wallace, G (2017) '3D Bioprinting and Controlled, Programmed Delivery' at 2017 Drug Delivery Australia Conference, Wollongong, 23-24 October.
68.	Wallace, G.(2017) invited panel member, alongside The Honorable Brad Hazzard, Minister for Health and Minister for Medical Research, Prof Paul Bannon (Prof of Cardiothoracic surgery, Sydney University & co-chair RPA Institute of Academic Surgery), A/Prof Cherry Koh (Colorectal surgeon RPA), Mr Ben Wright (Chief Innovation officer and head of Investment strategy at Cicada Innovation), Prof John Harris (Director Garnett Passe and Rodney Williams Memorial Foundation) at the Royal Australian College of Surgeons RACS NSW Surgeons month 2017, held in Sydney 24 October, for a workshop on 'Barriers to Surgical Innovation'.
69.	Cook, M. (2017) 'Chronic Intraventricular Valproate Therapy is Effective in Refractory Focal Epilepsy – Preliminary Results of a First-In-Man Study', 2017 Drug Delivery Australia Conference, Wollongong, 23-24 October.
70.	Macdonald, N (2017) Invited workshop on '3D printed microfluidic chips' Proceedings of the 21th International Conference on Miniaturized Systems for Chemistry and Life Sciences (21th microTAS), Savannah, USA , 22-26 October.
71.	Dodds, S. (2017) Emerging developments in medical research: 3D bioprinting, neurosurgical implants-medical innovation and "vulnerable" participants' invited presentation for the Asia-Pacific Regional Meeting for National Ethics/ Bioethics Committees "Promoting Health Ethics in the Sustainable Development Goals" chaired by the National Bioethics Committee, Republic of Korea, supported by the World Health Organization (WHO) and in collaboration with the United National Educational, Scientific and Cultural Organization (UNESCO). Seoul, Korea; 24-25 October.
72.	Cook, M. (2017) 'New design on the SEEG record', 7th CAAE International Epilepsy Forum (7th CIEF), Xiamen China, 29 October.
73.	Wallace, GG (2017) 'Biopolymers Making Better Humans' Academy of Science, Plastic Fantastic "Making Better Humans" event, Adelaide, 2 November * Open to Public
74.	Simonov, A. N. (2017) 'Resource and effort management for an early career scientist', Australia-India Workshop for Women in Energy Research Program, Melbourne, 6 November.
75.	O'Dell, L.A. (2017) What can magnetic resonance tell us about electrolyte materials? Australia-India Workshop for Women in Energy Workshop, Melbourne, 6 November.
76.	Wallace, G (2017) '3D Bioprinting: Printing Parts for Bodies' at First International Joint Symposium on Materials and Biomedical Engineering in Beihang University, Beijing, China, 6-7 November.
77.	Wallace, G (2017) '3D Bioprinting: Printing Parts for Bodies' at The International Forum on Innovation and Emerging Industries Development, Shanghai, China, 7-9 November.
78.	Gilbert F., Cook M, O'Brien T, Illes J., (2017) 'Embodiment and Estrangement: results from the First-in-Human BCI Trial' at the International Neuroethics Society, Washington, USA, 9-10 November.*Presentation was awarded travel stipend.
79.	Hancock, L (2017) 'Making Renewable Supply Chains Sustainable: Blending Science with Good governance' at 4th Annual Conference, India and Sustainability Standards: International Dialogues and Conference, 'From the Tragedies of the Commons to the Strategies for the Commons', 15-17 November.

APPENDIX 6: INVITED TALKS/PANELS GIVEN BY ACES MEMBERS	
80.	Moulton S (2017) 'Drug Eluting Implants for Non-Resectable Pancreatic Cancer Treatment', New Zealand/Australian Controlled Release Society Joint Workshop, Auckland, New Zealand, 22-23 November.
81.	Forsyth, M. (2017) 'Superconcentrated NaFSI based ionic liquid electrolytes; from understanding Na ⁺ ion transport to remarkable cycling and device stability' at the 4th International Conference on Sodium Batteries, Tokyo, Japan, 28-30 November 2017
82.	Alici, G (2017) 'Softer is Harder: What differentiates Soft Robotics from Hard Robotics?' 2017 MRS Fall Meeting and Exhibit (~6000 delegates) Boston, USA, 26 November - 1 December.
83.	Mozer, A (2017) 'The imitations of transient charge extraction techniques to measure charge carrier lifetime and materials energy levels in organic solar cells' at Australian Community for Advanced Organic Semiconductors (AUCOAS) conference, Kingscliffe, NSW, Australia, 4-6 December.
84.	Wallace, G (2017) 'Printing 3D structures containing living cells' at the 2017 Sydney Cardiovascular Symposium – 'Big Data and the Future of Cardiology' Victor Chang Cardiac Research Institute, Sydney 8 December.

Appendix 7: ACES work showcased in Invited Seminars / Collaborative Research Visits - 69 Visits to overseas laboratories

APPENDIX 7: INVITED SEMINARS / COLLABORATIVE VISITS RELATED TO ACES WORK	
1.	Hamilton, Charles (2017) ACES UOW masters visited Vlassak Group & Prof Zhigang Suo at Harvard University in USA to undertake collaborative project on 'Hydrogel Elastomer Device for Nerve Signal Sensing', Dec 2016-Feb 2017.
2.	Gilbert, Frederic (2017) ACES AI UTAS spent the year as a Visiting Scientist Fellow at the University of Washington in Seattle, working with both its Philosophy Department and Center for Sensiromotor Neural Engineering to work on the next generation of DBS and BCI: closed-loop devices for epilepsy, 2017.
3.	Zargami, Sara (2017) ACES UOW affiliate PhD visited Prof Keith Gordon at Otago University, New Zealand to undertake Raman spectroscopy on her samples, 3-14 January.
4.	Officer, DL (2017) ACES CI research visit with Prof Keith Gordon at Otago University, New Zealand, 11-13 January.
5.	Officer, DL (2017) ACES CI research visit with Dr Len Blackwell, Institute of Fundamental Sciences, Massey University, Palmerston North, New Zealand, 16 January.
6.	Geitman, Shaun (2017) ACES PhD Swinburne worked with Guangyuan Si at MCN Melbourne to undertake SEM analysis, 20 January.
	<p>Forsyth, M (2017) visited many international laboratories during her sabbatical in Spain February-September.</p> <p>7. Polymat, Spain</p> <p>8. Tecnalía, Spain</p> <p>9. CIC Enginere, Spain</p> <p>10. A/Prof Aninda Jiban Bhattacharyya (IITB) in Bangalore, India</p> <p>11. Prof Dominic Bresser laboratoires in Ulm Germany</p> <p>12. Prof Jelena Popovic at Max Planck, Stuttgart, Germany</p> <p>13. Prof. Peter Wasserschied, Erlangen – Helmholtz Institute, Germany</p> <p>14. Toyota labs in Tokyo, Japan</p> <p>15. Dr Rika Hagiwara lab in Kyoto Japan</p> <p>16. Dr Melanie Britton School of Chemistry, University of Birmingham, UK</p>
17.	Zhang, Long (2017) UOW affiliate PhD spent 6 months with ACES AI Simone Ciampi at Curtin University, Perth to study the electrostatic effect on the O-C bond of alkoxyamine molecules by STM facility, 13 February-August.

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18.	Chen, Zhi (2017) ACES PhD UOW worked at Save Sight Institute, Sydney Eye Hospital, working with Gerard Sutton; Simon Cooper; Jingjing You primarily to culture primary human corneal limbal epithelial cells, 1 March, 10 March, 31 March, 28 April, 29 May, 5 June, 6 July, 10 August, 1 September, 29 September, 7-9 November.
19.	Wang, C (2017) ACES SRF UOW visited Prof Jie Tang, Kiyoshi Ozawa, Dr Kun Zhang, Dr Xiaoling Yu, Yige Sun and Jing Li at the National Institute for Material Science (NIMS) and reviewed their facilities and held collaborative discussions on energy storage, 7 March.
20.	Wang, C (2017) ACES SRF UOW visited Prof Takao Someya at the University of Tokyo to review facilities and discuss potential collaborations, 9 March.
21.	Mozer, A (2017) ACES CI UOW visited Shinshu University to fulfill visiting A/Prof appointment, 12-23 March.
22.	Simonov, A (2017) ACES RF Monash visited Prof Ryu Abe at Kyoto University to discuss future collaborations, 10 March.
23.	Hancock, L (2017) visited the Luskin School of Public Affairs, UCLA, USA, 14-15 March.
24.	Spinks, Geoff (2017) ACES UOW CI visited University of British Columbia, Vancouver, Canada to perform collaborative research, 3-7 April.
25.	Alici, G (2017) visited Heart Institute, University of São Paulo Medical School (FM), Universidade de São Paulo, Brazil, to review facilities and explore ways of collaboration, on 5 April.
26.	Hoogeveen, D (2017) ACES Monash PhD visited ACES affiliate graduate Dr Shannon Bonke at Helmholtz Zentrum Berlin, Germany for a laboratory visit and discussion of ongoing collaborations, 7 April.
27.	Officer, DL (2017) ACES CI research visit in Prof Les Dutton's laboratory to discuss research collaboration, Johnson Foundation for Molecular Biophysics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, USA, 24-25 April.
28.	Officer, DL (2017) ACES CI research visit in Prof James Rusling's laboratory to discuss research collaboration, Department of Chemistry, University of Connecticut, Storrs, USA, 26-27 April.
29.	Simonov, A (2017) ACES RF Monash visited Dr D Silverster-Dean and Prof D Arrigan at Curtin University to discuss possible collaborations, April.
30.	Simonov, A (2017) ACES RF Monash visited Prof P Low, Prof M Baker, Prof R Atkin, Prof G Koutsantonis at the School of Molecular Sciences, University of Western Australia to present ACES research and discuss possible collaborations April.
31.	Simonov, A (2017) ACES RF Monash visited Prof S Donne and Prof E Wanless at the School of Life and Environmental Sciences, University of Newcastle to present ACES research and discuss possible collaborations, April.
32.	Wang, C (2017), visit to University of Western Sydney, working with Dr Rong Liu on characterisation of samples using SIMS, April.
33.	Pringle, J (2017) ACES CI visited Prof Peter Bruce and ACES PhD graduate Dr Liyu Jin at Oxford University, UK from 28 April - 13 May.
34.	Ralph, N (2017) Skype conference with the Centre for Research on Multinational Corporations (SOMO), Amsterdam, Netherlands working with Mark van Dorp, Senior Researcher to discuss ACES research on alternative energy companies and conflict, and potential collaborations, 3 May.
35.	Officer, DL (2017) ACES CI research visit with ACES PI Prof Dermot Diamond's laboratory to discuss research collaboration, Dublin City University, Dublin, 2-9 May.
36.	Wagner, P (2017) ACES SRF UOW visited Silesian University of Technology, Gliwice Poland on a collaborative research visit, 3 -21 May.

APPENDIX 7: INVITED SEMINARS / COLLABORATIVE VISITS RELATED TO ACES WORK	
37.	Crook, J (2017) visited Dr Michael Piper Laboratory at The School of Biomedical Sciences and The Queensland Brain Institute, The University of Queensland, Brisbane, Australia, to discuss collaborative research, to review facilities and to present a lecture, 8 May.
38.	Howlett, P (2017) ACES RF Deakin visited RMIT for meetings with John Andrews, Saeed Mohammadi, Francois Du Toit about the ONRG project, 8 May, 1 June and 4 August.
39.	Wagner, P (2017) ACES SRF UOW visited Warsaw University of Technology, Warsaw Poland on a collaborative research visit, 9-10 May.
40.	Siminov, A (2017) ACES RF Monash present a lecture at the University of Western Australia, Perth, Australia, with the view towards future collaboration, 12 May.
41.	Siminov, A (2017) ACES RF Monash present a lecture on solar fuels at the University of Newcastle, Newcastle, Australia, 15 May.
42.	Officer, DL (2017) ACES CI research visit with ACES PI Prof Dirk Guldi's laboratory to discuss research collaboration, Friedrich-Alexander-Universitaet (FAU) Erlangen-Nuernberg, Germany, 15-16 May.
43.	Officer, DL (2017) ACES CI research visit with the Max Planck Institute for Dynamics and Self Organization to discuss research collaboration, Göttingen, Germany, 17 -18 May.
44.	Ralph N (2017) ACES RF Deakin visited Prof Kuntala Lahiri-Ditt, Crawford School, ANU to attend presentation on 'Extractive Peasants and quarry mining in India', 19 May.
45.	Fang, J (2017) ACES Engineer Deakin visited Prof Guoxiu Wang gave a seminar on 'Electrospun Nanofibres and Their Applications' at the Centre for Clean Energy Technology and School of Mathematical and Physical Sciences, UTS, Sydney, 19 May.
46.	Ralph, N (2017) visited Ian Warren and Adam Molnar at the Criminology, Faculty of Arts and Education, Deakin University to discuss potential research collaborations under the 'Governance, Justice & Security Stream', May.
47.	Wang, X (2017) visited the Centre for Automated Manufacture of Advanced Composites and Centre for Sustainable Materials Research and Technology at UNSW, May.
48.	Howlett, P (2017) visited PMB defence and Drew Evans at University of South Australia, May.
49.	Howlett, P (2017) ACES CI Deakin participated in a teleconference, with Queensland University of Technology, on high capacity batteries for defense land domain, 16 June.
50.	Gilbert, F (2017) ACES AI UTAS was appointed as Visiting Scientist (June 1 2017-May 31 2018) at the National Core for Neuroethics, Division of Neurology, Department of Medicine, University of British Columbia, Vancouver, Canada.
51.	Simonov A (2017) ACES RF Monash visited Prof. E. Aziz, Dr. K. Aziz-Lange, Dr. A. Schnegg, Prof. K. Lips, Dr. M. Tech, Dr. I. Kiyan, Prof. A. Knop-Gericke, Dr. T. Petit at Helmholtz Zentrum Berlin, Frei Universitat, Fritz Haber Institute, to discuss the progress of the currently running joint projects and possibilities for new collaborations 2-27 June.
52.	Zhu, H (2017) AI ACES Deakin visited POLYMAT at the University of Basque Country in Spain, as a part of Endeavour Fellowship, 3 June -3 October.
53.	Gilbert F (2017) ACES AI Gilbert visited Prof Judy Illes from University of British Columbia, Vancouver, Canada to write a collaborative manuscript, 2-10 June.
54.	Pozo-Gonzalo C (2017) ACES RF Deakin visited Prof David Mecerreyes at Polymat, Spain to discuss Solid electrolytes/ membranes for Na-air batteries, 6 June.
55.	Wang, Caiyun (2017) ACES UOW SRF visited Prof Zongcheng Miao of Xijing University in Xi'an, China, to present a seminar on 'Organic Conductors with Tunable Properties for Energy Storage' and undertake a laboratory visit for collaborative discussions, 7 June.

APPENDIX 7: INVITED SEMINARS / COLLABORATIVE VISITS RELATED TO ACES WORK	
56.	Wang, Caiyun (2017) ACES UOW SRF visited Prof Wei Yan and Prof Shujiang Ding of Xi'an Jiaotong University to present a seminar on 'Organic Conductors with Tunable Properties for Energy Storage' and undertake a laboratory visit for collaborative discussions and the potential for visiting fellows and visiting PhD student exchange, 7 June.
57.	Wang, Caiyun (2017) ACES UOW SRF visited Prof Haihua Wang and A/Prof Liang Shao at Shaanxi University of Science and Technology to present a seminar on 'Polypyrrole nanotubes for anti-corrosion coating' and undertake a laboratory visit for collaborative discussions , 8 June.
58.	Pozo-Gonzalo C (2017) ACES RF Deakin visited Prof Teofilo Rojo at CIC Energigune to discuss air cathodes for Na-air batteries, 8 June.
59.	Coote, M.L. (2017) Lecture on 'Electrostatic Catalysis of Non-Redox Reactions' at Institute of Chemical Sciences And Engineering, Ecole Polytechnique Fédérale De Lausanne, 13 June.
60.	Fang J (2017) 'Electrospun Nanofibres and Their Applications in Energy Sectors' at School of Electronic and Information Engineering, China, when visiting A/Prof Xiaogan Li at Dalian University of Technology to discuss the collaboration on fibrous gas sensors, 16 June.
61.	Fang J (2017) Visited Prof Jun Gao and A/Prof Jinhai Ye at Nanjing Medical University in China to discuss possible collaboration on electrospun nanofibres as biomedical materials, 19 June.
62.	Gilbert F (2017) ACES AI Gilbert visited Dr Christian Ineichen from Biotech Campus, Geneva, Switzerland to write a collaborative manuscript, 22-26 June.
63.	Howlett, P (2017) ACES CI Deakin gave a seminar on 'Mixed salt systems and solid electrolytes for safe and stable batteries' at Vrije Universiteit Brussel in Belgium on 26 June.
64.	Hill, N (2017) ACES PhD ANU undertook a collaboration visit to work with CBK group at QUT, Brisbane in June.
65.	Howlett, P (2017) ACES CI Deakin gave a tutorial at CIC in Spain on 'Organic Ionic Plastic Crystals as Solid-State Electrolytes', 2 July.
66.	Alici, G (2017) visited Max Planck Institute for Intelligent Systems, Stuttgart, Germany, to review facilities and explore ways of collaboration, and to deliver an invited seminar ' From Soft Actuators to Soft Robotics: where are we now?' 10 July.
67.	Alici, G (2017) visited Duisburg-Essen University, Department of Mechatronic Engineering, Germany, to review facilities and explore ways of collaboration, as well as to deliver an invited seminar 'Soft Robotics: is it a new paradigm in robotics?', 14 July.
68.	Fang, J (2017) ACES RF Deakin visited 'Save the Sight Institute' at the University of Melbourne to discuss conducting electrochemical testing on neural electrodes, 15 August.
69.	Zhou, F (2017) ACES RF Monash visited Dr Hamish Grant at Bio21 Institute, University of Melbourne for discussion on NMR samples and testing 8 August, then for analysing NMR samples and discuss results, 16 August.
70.	Cook, M (2017) ACES CI visited Earl Bakken Centre, University of Minnesota regarding joint work, 23 August.
71.	Wang, C (2017) ACES CI visited Mechanical, Materials, Mechatronic and Biomedical Engineering (MMMB) at UOW to discuss the collaborative project with Prof Weihua Li and Dr. Michael Ling from DSTG, August.
72.	Wagner, P (2017) ACES SRF UOW visited Curtin University, Perth Western Australia, on a collaborative research visit with ACES AI Ciampi, 28 August to 1 September.
73.	Alici, G (2017) ACES UOW CI visited the Sydney Children Hospital and Prince of Wales Hospital, Dept of Rehabilitation and Spinal Medicine, Sydney, to explore the possibility of collaborating on the ACES prosthetic hand, and ask their help to promote the survey on what prosthetic hand users want from a new hand prosthesis, 7 September.

APPENDIX 7: INVITED SEMINARS / COLLABORATIVE VISITS RELATED TO ACES WORK	
74.	Officer, DL (2017) ACES UOW CI research visit Centre for Organic Electronics to discuss future solar cell project with Mr Wade Blazley (CEO, Solafast) and Prof Paul Dastoor, University of Newcastle, Newcastle, Australia, 11 September.
75.	Coote, M.L. (2017) 'Electrostatic Catalysis of Non-Redox Reactions' at the Chemistry Seminar Series, School of Physical Sciences, University of Tasmania, 14 September.
76.	Pringle, J (2017) ACES Deakin CI visited Dr Yuri Andreev at St Andrews University, UK to discuss XRD analysis of plastic crystals, 18 September.
77.	Tomaskovic-Crook, E (2017) ACES RF UOW visited Michael Morris from Bosch Institute (USydney) for discussion around possible collaborations, 22 September.
78.	Gilbert F (2017) ACES UTAS AI visited the University of British Columbia, Vancouver, Canada to work with Prof Judy Illes and A/Prof Julie Robillard on writing a grant, 1-14 October.
79.	Siminov, A (2017) ACES RF Monash present a lecture on 'Understanding electromaterials: an integrated instrumental and theoretical approach' at James Cook University, Townsville, Australia, 3 October.
80.	Bourke, J (2017) ACES UOM RF visited UOW SMAH researchers Lezanne Ooi and Martin Engel to discuss MEA project design, 3 October.
81.	Wagner, P (2017) ACES UOW RF visited Shinshu University, Ueda, Japan as a Specially Appointed Visiting Associate Professor, to discuss new collaborative projects, 9-24 October.
82.	Mozer, A (2017) ACES UOW CI visited Shinshu University, Ueda, Japan as a Specially Appointed Visiting Associate Professor, to discuss new collaborative projects, 9-24 October. The aim was to measure electron transfer rates of newly designed cobalt redox mediators- a publication is expected. The staff member will continue to learn computational techniques for molecular modelling using Gaussian from collaborator Shogo Mori.
83.	Fournier, M and Simonov A (2017) ACES RFs Monash visited Australian Synchrotron working with Dr Rosalie Hocking, Dr Bernt Johannessen, Ms. H. King on 'in situ XAS studies of water oxidation electrocatalysts', 20-26 October.
84.	Gilbert F (2017) ACES AI UTAS was invited as guest lecturer to present his research to Neural Engineering classes at the Department of Engineering, University of Washington, Seattle, 26 October.
85.	Periyapperuma, K (2017) ACES PhD Deakin had a meeting to discuss design of a GC cell apparatus to collect and identify gases produced during electrochemical reactions with James Maina and Dr Ludovic Dumee at Deakin University, Geelong as they have expertise in Materials Chemistry and Materials Engineering, October.
86.	Wang X (2017) ACES Deakin CI visited Professor Antonella Motta's laboratory, Department of Industrial Engineering, Trento University, Italy, to discuss research collaboration in silk biomaterials, October.
87.	Walker, M (2017) ACES RF Monash met with Dr Allan McCay Sydney University (Law) to discuss a proposed joint paper, 2 November.
88.	Higgins, M (2017) ACES CI UOW visited Kanazawa University Japan and present at CHOZEN symposium, 9-10 November.
89.	Sparrow, R (2017) ACES CI took up a visiting fellowship at the Chinese University of Hong Kong to conduct collaborative research, 8 November -7 December.
90.	Chen J (2017) ACES CI attended the collaborative meeting at Shanghai Jiao Tong University and Eastern China University of Science and Technology, China, 10-12 November.
91.	Officer, DL (2017) ACES CI research visit with Prof Keith Gordon, Department of Chemistry, University of Otago, Dunedin, New Zealand, 11-12 November.

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92.	Farajikhah S (2017) ACES UOW PhD visited RMIT textile and fashion school to make segmented knitted structures for eChem detection on textiles, 12-17 November.
93.	Ralph, N (2017) ACES RF Deakin visited Delhi, India with A/Prof Devleena Ghosh, University of Technology Sydney, to discuss Ghosh/UTS projects, including 'The Coal Rush' focused on Australia, India, Germany and a new project on Energy Transitions, 20 November.
94.	Ralph, N (2017) ACES RF Deakin visited TERI University (The Energy and Resources Institute), Delhi, India, working with Prof Sapna Narula to discuss potential collaborations Prof Narula's team and the broader TERI, 21 November.
95.	Sparrow, R (2017) ACES CI Monash held talks on Sex Robots with Dr Ole-Martin Moen, University of Oslo, Norway, 24 November.
96.	Simonov, A. N. (2017) ACES SRF Monash lecture on 'Renewable fuels' at Victoria University of Wellington, Wellington, New Zealand, 28 November.
97.	Chen, Z (2017) ACES UOW PhD Student visited Sydney University to undertake flow cytometry on his samples, 29 November.
98.	Marc in het Panhuis (2017) ACES CI UOW visited Harvard School of Engineering and Applied Sciences, to discuss our ongoing collaboration and visit from Harvard researchers to ACES during 2018, 1 December.
99.	Simonov, A (2017) ACES RF Monash visited Helmholtz Zentrum Berlin to follow up on discussions held in June about the progress of the currently running joint projects and possibilities for new collaborations 1-14 December.
100.	Higgins, M (2017) ACES CI UOW visited Prof Takayuki Uchihashi at Nagoya University Japan to further the collaboration on high speed AFM (collaborations on making AFM movies of electrochemical reactions and processes at material surfaces) and Hanbat University Korea to deliver lectures to masters students, 9-15 December.
101.	Officer, DL (2017) ACES CI research visit Centre for Organic Electronics to discuss future electrochromic project with Mr Johnny Pak (CEO, iGlass) and Prof Paul Dastoor, University of Newcastle, Newcastle, Australia, 11 December.
102.	Simonov, A. N. (2017) ACES RF Monash lecture 'Understanding electromaterials for solar fuel synthesis via advanced spectro-electrochemical approach' at Freie Universitat Berlin, Berlin, Germany, 11 December.
103.	Simonov A (2017) ACES RF Monash visited University of St. Andrews, St. Andrews, Scotland to review facilities and discuss potential collaboration opportunities, 15-17 December.

Appendix 8: Conference Presentations

A List of ACES conference presentations not listed in previous tables. Note that the lists included in this report do not contain presentations by ACES members at ACES run events.

APPENDIX 8: CONFERENCE PRESENTATIONS BY ACES MEMBERS IN 2017	
1.	Higgins, M (2017) oral at the Australian Colloid and Interface Society Conference, 29 January -4 February.
2.	Puckert C, Tomaskovic-Crook E, Wallace G, Crook J, Higgins M (2017) Oral ' Electro-mechanical properties of Hydrogels and their interactions with human neural stem cells using AFM', 8th Australian Colloid and Interface Symposium, Coffs Harbour, Australia, 29 January- 2nd February.
3.	Pringle, J. M. (2017) Development of organic ionic plastic crystals as solid-state electrolytes for energy applications at the 8th International Conference on Advanced Materials and Nanotechnology AMN8, Queenstown, New Zealand, 12-16 February.
4.	Wagner P, Wagner K, Officer D. L.(2017) Oral 'Colourful chemistry of spiropyrans', 8th International Conference on Advanced Materials and Nanotechnology AMN8, Queenstown, New Zealand, 12-16 February.

APPENDIX 8: CONFERENCE PRESENTATIONS BY ACES MEMBERS IN 2017	
5.	Sutton JJ, Wagner P, Officer DL, Gordon KC (2017), 'Donor acceptor distance in thiophene bridge dyes: a spectroscopic and computational study', 8th International Conference on Advanced Materials and Nanotechnology AMN8, Queenstown, New Zealand, 12-16 February.
6.	Hancock, L and N Ralph (2017) Oral 'Big Energy and the Political Economy of Energy Policy in Australia: Future High Voltage Superpower or Backwater State?' at the International Studies Association (ISA) 'Understanding Change in World Politics', 58th Annual Convention, Baltimore, United States, 22-25 February.
7.	Bonke S, Tesch M, Aziz E, Shaker M, Xiao J, Schwanke C, Lange K, Bond A, Spiccia L, Simonov A (2017) poster "Parametrisation of electrocatalytic water oxidation: understanding the mechanism and guiding operando spectroscopic studies" at the Gordon Research Seminar and Conference on Nanomaterials for Applications in Energy Technology, USA, 26 February-3 March.
8.	Spinks, G.M. (2017) 'Materials and Fabrication Strategies for Artificial Muscles' SPIE Smart Structures and Materials + Nondestructive Evaluation and Health Monitoring, Portland, Oregon, USA, 4-8 March 2017.
9.	Spinks, G.M. (2017) 'Stretchable Polymer Artificial Muscles' SPIE Smart Structures and Materials + Nondestructive Evaluation and Health Monitoring, Portland, Oregon, USA, 4-8 March 2017.
10.	Zhang, Y (2017) Poster presentation 'Toward a Sodium-Air Battery with Ionic Liquid Electrolyte: Effect of Sodium Salts Concentration on Charge-Discharge Behaviors', International Battery Association Conference (IBA 2017), Nara, Japan, 5-10 March.
11.	Pozo-Gonzalo, C (2017) Poster International Battery Association Conference (IBA 2017), Nara, Japan, 5-10 March.
12.	Periyapperuma, K (2017) Poster International Battery Association Conference (IBA 2017), Nara, Japan, 5-10 March.
13.	Di Bella C, Duchi S, Onofrillo C, Blanchard R, Pivonka P, O'Connell CD, Wallace G, Choong PFM (2017) Poster 'Co-axial bio-printing of stem cells for the regeneration of articular cartilage' at the Orthopaedic Research Society (ORS) 2017 Annual Meeting, San Diego, CAL, USA, 19-22 March.
14.	Hoogeveen, D (2017) Presented Poster entitled 'Photo-Electrocatalytic H ₂ Generation At Dye-Sensitised Electrodes Functionalised With A Metallic Catalyst' at Light Harvesting Processes 2017 at Kloster Banz, Upper Franconia, Germany, 26-30 March.
15.	Officer, D. L., Hobbs, C., Roach, N., Mitchell, R., Wagner, K., Wagner, P., Barnsley, J. E., Gordon, K. C., Kodali, G., Moser, C., Dutton P. L. (2017) Poster 'A Porphyrin Protein Maquette-Based Photovoltaic Device', 2017 Materials Research Society (MRS) Spring Meeting and Exhibit, Phoenix, USA, 17-21 April.
16.	Barsby, T., Quigley, A., Bourke, J., Crook, J., Wallace, G.G. & Kapsa, R. (2017) Poster 'Biomaterial Optimisation for 3-Dimensional Neural Tissue Constructs' at Australasian Society for Biomaterials and Tissue Engineering (ASBTE) Annual Meeting, Canberra, ACT, 18-20 April.
17.	Bourke, J, A Quigley, C O'Connell, G Wallace, M Cook, R Kapsa (2017) Oral entitled 'Functional neuronal networks – 2D versus 3D' at Australasian Society for Biomaterials and Tissue Engineering (ASBTE), Canberra, 18-20 April.
18.	J Bourke, A Mohammadi, W Shaw-Cortez, R Garcia Rosas, A Quigley, C O'Connell, C Ngan, G Wallace, M Cook, P Choong, D Oetomo, R Kapsa (2017) Poster 'Intuitive prosthetic hand control using electrophysiology' at ASBTE 18-20 April.
19.	Quigley A, Kita M, Bourke J, Sweerts K, Crook J, Wallace GG and Kapsa RMI (2017) Oral on 'Skeletal Muscle Progenitor Delivery by Trojan Hydrogel Fibres' at ASBTE 18-20 April.
20.	Duchi S, Onofrillo C, O'Connell CD, Pivonka P, Blanchard R, Quigley A, Kapsa R, Wallace G, Di Bella C, Choong PFM (2017) Oral 'Chondrogenic differentiation with an innovative hand-held device for co-axial 3D Bioprinting of Stem Cells-laden hydrogels' at The Australasian Society for Biomaterials and Tissue Engineering (ASBTE) 25th Conference, Canberra, 18-20 April.

APPENDIX 8: CONFERENCE PRESENTATIONS BY ACES MEMBERS IN 2017	
21.	Higgins, M (2017) oral at The Australasian Society for Biomaterials and Tissue Engineering (ASBTE) 25th Conference, Canberra, 18-20 April.
22.	O'Connell CD, Zhang B, Yu I, Liu E, Di Bella C, Duchi S, Onofrillo C, Quigley A, Blanchard R, Pivonka P, Bourke J, Kapsa R, Choong PFM, Wallace G.(2017) Oral 'Tailoring the Mechanical Properties of Hydrogels for Tissue Engineering' at The Australasian Society for Biomaterials and Tissue Engineering (ASBTE) 25th Conference, Canberra, 18-20 April.
23.	Walker, MJ (2017) 'Precising definitions as a way to combat overdiagnosis' (with Wendy Rogers). Presented at 'Too Much Medicine: Exploring the relevance of philosophy of medicine to medical research and practice', Oxford, UK, 19-20 April.
24.	Ralph N, Hancock L (2017) paper entitled 'Alternative energy technologies, supply chains and corporate peace-building' presented to Department of Politics and International Studies (POLIS) at Deakin University, Melbourne, 21 April.
25.	Gietman S, Kapsa R, Stoddart P, Moulton S (2017) Oral 'Synthesis of Optically Active Drug Delivery Systems' at AusMedtech and International Conference on Mechanics in Medicine and Biology (ICMMB), 24-25 May.
26.	Bourke J, Mohammadi A, Shaw-Cortez W, Garcia Rosas , Quigley A, Shekibi B, O'Connell C, Ngan C, Wallace G, Cook M, Choong P, Oetomo D, Kapsa R (2017) Poster 'Intuitive prosthetic hand control by neural input', AusMedtech and International Conference on Mechanics in Medicine and Biology (ICMMB), Melbourne, 24-25 May.
27.	Caballero Aguilar, L (2017) Oral 'Preparation and characterisation of polycaprolactone-alginate microspheres for drug delivery' at AusMedTech & ICMMB 2017, Melbourne, 24-25 May.
28.	Duc, D (2017) Oral 'Fabrication of Electrical and Optical Cell Co - Stimulation Materials' at Australia's MedTech Conference & International Conference of Mechanics in Biology and Medicine (ICMMB), Melbourne, 24-25 May.
29.	Barsby, T., Quigley, A., Bourke, J., Crook, J., Wallace, G.G. & Kapsa, R. (2017) Poster 'Studying the Brain Without Studying the Brain: 3D Neural Constructs from Human iPSCs' Australasian Society for Stem Cell Research (ASSCR) Annual Meeting, Sydney, NSW, 24-26 May.
30.	Tomaskovic-Crook E, et al (2017) 'Building brain-organoids through 3D bioprinting: Towards 3D Modelling of Neural Development, Disease and Regenerative Medicine', Joint 10th Australasian Gene Therapy Society (AGCTS) & Australian Society of Stem Cell Research (ASSCR Conference), Sydney, Australia, 24-26 May.
31.	Hancock L, Ralph N, Ali S.H. (2017) Bolivia's Lithium Frontier: Can Cleaner Technologies Harness a Mineral Development Boom?, paper presented by L. Hancock at the 6th International Workshop on Cleaner Production, organised by Journal of Cleaner Production, Brazil, 24-26 May
32.	Duc, D. (2017) 'Fabrication of Electrical and Optical Cell Co-Stimulation Materials', Australian Society for Medical Research (ASMR) Victorian Student Symposium, Melbourne, 1 June.
33.	Gietman S (2017) 'Synthesis of Optically Active Drug Delivery Systems' at ASMR student symposium, 1 June.
34.	Wang C (2017) Oral 'Manipulating Conducting Polymers for Application in Batteries' at 2nd China Forum on Energy Materials Chemistry, Changsha, 9-12 June.
35.	Chen, J. (2017) 'Metal-Carbide as Cathode for Rechargeable Li-CO ₂ and/or Li-Air Battery', at the 2nd China International Forum on Energy Materials and Chemistry, Changsha, China, 10 -12 June.
36.	Walker M (2017) Oral 'Population-level evidence and patient-specific devices' at the International Philosophy of Medicine Roundtable Conference, Toronto, 23-24 June.
37.	Niall P. Macdonald, Sinéad A. Currivan, Laura Tedone, and Brett Paull (2017) 'Direct Production of Microstructured Surfaces for Planar Chromatography Using 3D Printing' at 9th International Symposium on Microchemistry and Microsystems (ISMM) and the 5th Asia-Pacific Chemical and Biological Microfluidic Conference (APCBM) together with the 8th Australia New Zealand Nano-Microfluidics Symposium (ANZNMf) in Hobart (Australia), 26-29 June.

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38.	Zhang, J (2017) poster at the 2nd Annual Innovation Showcase Symposium, an event organized by the Chemicals and Plastics Manufacturing Innovation Network, enabling ACES research to be showcased to a distinguished audience of government and industry leaders, 2nd July.
39.	Blum A (2017) Oral 'Cognitively Disabled Children: Kantian and Aristotelian Views of Personhood' at Australasian Association of Philosophy Annual Conference, 3 July.
40.	Anver H. M. C. M., Mutlu R., and Alici G. (2017) "3D Printing of a Thin-Wall Soft and Monolithic Gripper Using Fused Filament Fabrication", 2017 IEEE/ASME International Conference on Advanced Intelligent Mechatronics, pp.442-447, Munich, Germany, 3-7 July.
41.	Zhou H. and Alici G., 'Modeling and Experimental Characterization of Magnetic Membranes as Soft Smart Actuators for Medical Robotics', 2017 IEEE/ASME International Conference on Advanced Intelligent Mechatronics, pp.797- 802, Munich, Germany, 3-7 July.
42.	Adesanya O (2017) 'Patents and Ethical Exclusions: Keeping up the Pace with Technological Advancements (A case study on Bioprinting)' at Australasian IP Academics Conference 21 July.
43.	Pringle, J. M. (2017) Oral 'Ionic Liquid-based redox electrolytes for thermal energy harvesting' at RACI National Centenary Conference, Melbourne, Australia, 23-28 July.
44.	Noble, B. (2017) Oral 'Stereoregulation in the Radical Polymerization of Methacrylate Salts', Royal Australian Chemical Institute (RACI) Centenary Conference, Melbourne, Australia, 23 -28 July.
45.	C-Y. Lee, Y. Zhao, C. Wang, D. G. Mitchell, G. G. Wallace (2017) oral 'Self-organised silver nanosheets; an efficient and rapidly formed CO ₂ reduction electrocatalyst' at RACI National Centenary Congress, Melbourne, 23-28 July.
46.	Spinks, G.M.(2017) Oral 'Bionic Artificial Muscles' at RACI National Centenary Congress 2017, Melbourne, 23-28 July.
47.	Macdonald N, Bunton GL, Young Park AH, Breadmore MC, and Kilah NL (2017) '3D printed micrometre-scale polymer mounts for single crystal analysis ' at RACI Centenary Congress 2017, Melbourne Australia, 23-28 July.
48.	Simonov, A (2017) Oral 'Understanding the mechanism of electrocatalytic water oxidation: an integrated kinetic and spectroscopic approach' at RACI Centenary Congress 2017, Melbourne Australia, 23-28 July.
49.	Li, Fengwang (2017) Oral 'Two-Dimensional Electrocatalysts for CO ₂ Reduction' at RACI Centenary Congress 2017, Melbourne Australia, 23-28 July.
50.	Officer D L, Xiao Y, Zarghami S, Wagner P, Wagner K (2017) Oral '3D Light-controlled movement of microdroplets', Royal Australian Chemical Institute (RACI) Centenary Congress 2017, Melbourne, Australia, 23 -28 July.
51.	Wagner K, Hobbs C, Roach N, Mitchell R, Wagner P, Barnsley J, Gordon K C, Kodali G, Moser C, Dutton P L, Officer D L (2017) Oral 'Porphyrin protein maquette-based reaction centres and their application in photovoltaic devices', Royal Australian Chemical Institute (RACI) Centenary Congress 2017, Melbourne, Australia, 23-28 July.
52.	Xiao Y, Zarghami S, Wagner P, Wagner K, Officer DL (2017) Poster 'Developing photosensitive droplets for chemopropulsion', Royal Australian Chemical Institute (RACI) Centenary Congress 2017, Melbourne, Australia, 23 -28 July.
53.	Zarghami S, Xiao Y, Wagner K, Wagner P, Barnsley JE, Gordon KC, Officer D L (2017) Poster 'Investigating the light induced motion of microdroplets', Royal Australian Chemical Institute (RACI) Centenary Congress 2017, Melbourne, Australia, 23-28 July.
54.	Zhang, J (2017) Oral 'Two-dimensional electrocatalysts for CO ₂ reduction', Royal Australian Chemical Institute Centenary Congress 2017, Melbourne, Australia, 23-28 July.

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55.	Begić S, Jónsson E, Chen F, Forsyth M. (2017) 'The Physics of Ionic Liquids near Graphene Interfaces: New Insights from Molecular Dynamics Simulations' at 8th International Discussion Meeting on Relaxation in Complex Systems, Wista, Poland, 23-28 July.
56.	Gu Q, Tomaskovic-Crook E, Zhou Q, Wallace GG, Crook JM (2017) 3D printing human iPSCs to produce neural tissues. 19th International Conference on Biotechnology and Advanced Biothermodynamics, Istanbul, Turkey, 27-28 July.
57.	Spinks, G.M. (2017) 'Bionic Artificial Muscles' at the Royal Australian Chemical Institute (RACI) Centenary Congress 2017, Melbourne, Australia, 23-28 July.
58.	Chen, J (2017) Oral 'Thermo-Electrochemical Cells: Using Redox-Gel Integrated Flexible Electrodes to Covert Body Heat into Electricity', at 2017 International Symposium on Energy Conversion and Storage Materials (ISECSM), Brisbane, Australia, 31 July -3 August.
59.	Lee C.-Y., Taylor A. C., Beirne S., Wallace G. G. (2017) oral '3D Metal Printing: A Versatile Approach in Patterning Photoelectrodes' at 2017 ISECSM, Brisbane, Australia, 31 July -3 August.
60.	Howlett, P (2017) oral 'Novel salt based electrolyte materials enabling Li and Na metal devices' at 2017 ISECSM, Brisbane, Australia, 31 July -3 August.
61.	Pringle, J (2017) oral 'Harvesting thermal energy using redox-active electrolytes', at 2017 ISECSM, Brisbane, Australia, 31 July -3 August.
62.	Wang, C (2017) oral 'Manipulating conducting polymers for application in batteries' at 2017 ISECSM, Brisbane, Australia, 31 July -3 August.
63.	Mozer, A (2017) oral 'Precise control of interfacial electron transfer rate: The effect of tridimensional molecular shape and size of exposed orbitals' at 2017 ISECSM, Brisbane, Australia, 31 July -3 August.
64.	Nattestad, A (2017) oral 'A charge generation mechanism based on Triplet-Triplet Annihilation for enhanced red light utilisation in organic based solar cells' at 2017 ISECSM, Brisbane, Australia, 31 July -3 August.
65.	Lee, CY (2017) oral 'Self-organised silver nanosheets: an efficient and rapidly formed CO ₂ reduction electrocatalyst' at 2017 ISECSM, Brisbane, Australia, 31 July -3 August.
66.	Chen, J (2017) 'Metal-Carbide as Cathode for Rechargeable Li-CO ₂ and/or Li-Air Battery', at Catalyst and Catalysis Form (CCF) 2017, Griffith University, Gold Coast, Australia, 4-5 August.
67.	Barsby, T., Quigley, A., Duchi, S., Bourke, J., Crook, J., Wallace, G.G. & Kapsa, R. (2017) Poster Presentation – "Studying the Brain Without Studying the Brain: 3D Neural Constructs from Human iPSCs" Aikenhead Centre for Medical Discovery (ACMD) Research Week, Melbourne, Victoria, 7-10 August.
68.	Bourke J, Mohammadi A, Shaw-Cortez W, Rosas R, Quigley A, Shekibi B, O'Connell C, Ngan C, Wallace G, Cook M, Choong P, Oetomo D, Kapsa R (2017) Poster 'Electrophysiology for Robotic Prosthetic Hand Control', ACMD research week, St Vincent's Hospital, Melbourne, 7-10 August.
69.	Onofrillo C., Duchi S., O'Connell CD., Blanchard R., Quigley A., Kapsa RMI., Wallace GG., Di Bella C., Choong PFM (2017) Oral and poster 'Rapid photocrosslinking of Core/Shell Bioink for in situ intra-surgical application'. ACMD research week, St Vincent's Hospital, Melbourne, 7-10 August.
70.	Duchi S, Onofrillo C, D O'Connell C, Augustin C, Quigley A, Blanchard R, Pivonka P, Wallace GG, Di Bella C, Choong PFM (2017) Poster 'The hand-held Biopen system as a tool to produce core/shell bioscaffolds for cartilage regeneration', Aikenhead Centre for Medical Discovery (ACMD) Research Week, Melbourne, Victoria, 7-10 August.
71.	Blum, A. (2017) 'Ethics of 3D bioprinted human tissues' at European Society for Philosophy in Medicine and Healthcare (ESPMH) conference, Belgrade, 16-19 August.

APPENDIX 8: CONFERENCE PRESENTATIONS BY ACES MEMBERS IN 2017	
72.	Walker, MJ (2017) 'Can we replace our limbs? Self-constitution, embodiment, and advanced prosthetics' at European Society for Philosophy in Medicine and Healthcare (ESPMH) conference, Belgrade, Serbia, 16-19 August.
73.	Sparrow R (2017) 'Artificial Organs and Obsolescence' at 31th European Conference on Philosophy Of Medicine And Health Care: Emerging Technologies In Healthcare, Belgrade, 16-19 August.
74.	Noble, B. (2017) Poster 'Anodic Fragmentation of Alkoxyamines: Generating Nitroxides with Electricity' at the 254th American Chemical Society (ACS) Meeting, Washington DC, USA, 20 -24 August.
75.	Abdul Rahim SN, Huang XF, Wallace GG, Gilmore1 K, Crook JM (2017) Poster 'The Effects of Electrical Stimulation Mediated by Polypyrrole/Dodecylbenzene Sulfonic Acid on Hypothalamic Neurons and a Hypothalamic Model of Schizophrenia' at International Conference of Theoretical and Applied Nanoscience and Nanotechnology (TANN'17), Toronto, Canada, 23-25 August.
76.	Noble, B (2017) Poster 'The Effects of Lewis Acid Complexation on Type I Radical Photoinitiators' at the World Association of Theoretical and Computational Chemists (WATOC) Conference, Munich, Germany, 27-31 August.
77.	Xiao, C (2017) Oral presentation at 68th Annual Meeting of the International Society of Electrochemistry, Providence, Rhode Island, USA, 27 August - 1 September.
78.	Adesanya O (2017) 'Patenting Bioprinting: An Ethical Dilemma in the Provision of Accessible Health Technologies', UTAS 2017 Graduate Research Conference, 8 September.
79.	Pringle, J. M. (2017) 'IL-based redox electrolytes for thermal energy harvesting at the Ionic Liquids: From fundamental properties to practical applications' at the Faraday Discussion, Cambridge, UK, 11-13 September.
80.	Dodds, S, Goddard, E., and Blum, A (2017) Oral co-presented by E. Goddard and A. Blum 'That is my mini-brain' Minding the gap between in vitro and in vivo neural activity at the Neuroscience and Society Conference, Sydney, 15 September.
81.	Barsby T, Quigley A, Duchi S, Bourke J, Crook J, Wallace G.G. & Kapsa R. (2017) Poster 'Studying the Brain Without Studying the Brain: 3D Neural Constructs from Human iPSCs', Biomimetics, Artificial Muscles and Nano-Bio (BAMN) Conference, Wollongong, NSW, 25-27 September.
82.	Bourke J, Mohammadi A, Shaw-Cortez W, Rosas R, Quigley A, Shekibi B, O'Connell C, Ngan C, Wallace G, Cook M, Choong P, Oetomo D, Kapsa R (2017) Poster 'Innovations in Personalised Medicine: Electrophysiology for Epilepsy and Prosthetic Limbs', BAMN2017, University of Wollongong, Poster 25-27 September.
83.	Chen, Zhi (2017) Poster 'Electrocompacted collagen membrane for corneal epithelial bioengineering', BAMN2017, University of Wollongong, Poster 25-27 September.
84.	Tomaskovic-Crook E, Zhang B, Gu Q, Wallace GG, Crook JM (2017) Poster 'Biomimetics of 3D printed GelMA: A substrate for the generation of neural organoids from human induced pluripotent stem cells for disease modelling'at 9th World Congress on Biomimetics, Artificial Muscles and Nano-Bio (BAMN), Innovation Campus, University of Wollongong, 25-27 September.
85.	Sayyar, S., Officer, D. L., Wallace, G. G. (2017) Poster '3D Structured Conducting Biocomposites for Tissue Engineering', 9th World Congress on Biomimetics, Artificial Muscles and Nano-Bio, Wollongong, Australia, 25-27 September.
86.	Spinks, G.M. (2017) Oral 'Effect of Stretch on Artificial Muscles' at BAMN2017: Biomimetics, Artificial Muscles and Nano-Bio, Wollongong, 25-27 September.
87.	Ralph N, L Hancock and D MacFarlane (2017) Can Australia Become an Alternative Energy Superpower? Political Economy and International Relations Impacts of Australia's Potential Alternative Energy Exports to Asia, paper presented at the 'Democracy and Populism: A New Age of Extremes?' conference, Australian Political Studies Association, Melbourne, 25-27 September.

APPENDIX 8: CONFERENCE PRESENTATIONS BY ACES MEMBERS IN 2017	
88.	Salahuddin, B (2017) Oral 'Hydrogel Based McKibben Muscles' at Biomimetics, Artificial muscles and Nano-bio, Biomimetics, Artificial Muscles and Nano-Bio (BAMN) Conference, Wollongong, NSW, 25-27 September.
89.	Cabot JM, Breadmore MC and Paull B (2017) 'Fibre based platforms for direct analysis of metabolites in complex samples', Proceedings of the 21th International Conference on Miniaturized Systems for Chemistry and Life Sciences (21th microTAS), Savannah, USA, 22-26 October.
90.	Mehrpouya F (2017) ACES UOW PhD student had a poster presentation at the Drug Delivery Australia Conference, Wollongong, 27-28 October.
91.	Naquia SA R, Huang XF, Wallace GG, Gilmore K, Crook JM (2017) Poster 'The effects of electrical stimulation and conductive polymer on hypothalamic neurons in psychiatric disorders' at 7th Annual Scientific Meeting Biological Psychiatry Australia, Wollongong, 29-31 October.
92.	Feng, Le (2017) Oral 'Point-of-care Analysis of targets from complex biological and environmental samples by integrated micro/nanofluidic devices' at HPLC 2017, Jeju, South Korea, 4-9 November.
93.	Viaña JMN, Illes J, Gilbert, F., (2017) Oral 'Ethical Considerations for Cell Implantation in Alzheimer's Disease', Abstract from International Neuroethics Society, Washington, DC, 9-10 November.
94.	Feng Le (2017) Oral 'Tunable fluid mixing in 3D printed microfluidic chips fabricated with various printing orientations', APCE 2017, Shanghai, China, 10-13 November.
95.	Hancock L (2017) 'New governance models for developing country transitions to renewable energy' at India and Sustainability Standards: International Dialogues and Conference, 'From the Tragedies of the Commons to the Strategies for the Commons', India, 15-17 November.
96.	Ralph, N. (2017) ACES Deakin RF 'Business and Their Contribution to the Sustainable Development Goals', presented at India and Sustainability Standards International Dialogues and Conference, New Delhi, India, 15-17 November.
97.	Wu L, Farajikhah S (2017) ACES UOW PhD students presented their ACES research at the ANFF & AMMRF research showcase, Sydney 22-23 November.
98.	Zhang, J (2017) Oral presentation 'Electrochemical Reduction of CO ₂ on Defect-rich Bi Derived from Bi ₂ S ₃ ', RACI Victorian Inorganic Chemistry Symposium, La Trobe University, Melbourne, 24 November.
99.	Barsby T, Quigley A, Duchi S, Bourke J, Crook J, Wallace GG, Kapsa R (2017) Oral 'Studying the Brain Without Studying the Brain: 3D Neural Constructs from Human iPSCs', BioFab3D and UniMelb Neuroscience Workshop, 27 November.
100.	Zhang, Y (2017) Oral presentation 'Electrochemical Reduction of CO ₂ on Defect-rich Bi Derived from Bi ₂ S ₃ ', RACI Victorian Inorganic Chemistry Symposium, La Trobe University, Melbourne, November.
101.	Chen J (2017) Oral 'Additive Fabrication Approaches - An Introduction 3D Printing @ACES', at First International Joint Symposium on Materials and Biomedical Engineering, Beihang University, Beijing, China, 5-9 November.
102.	Dupont M F, Russo M. MacFarlane D.R, Pringle J.M (2017) Oral 'Hydrogel Electrolytes for Thermal Energy Harvesting', Materials Research Society Fall Meeting and Exhibit 2017, Boston, USA, 26 November- 1 December.
103.	Dupont M. F., MacFarlane D.R, Pringle J.M. (2017) Poster 'Thermo-electrochemical Cells for Waste Heat Harvesting', Materials Research Society Fall Meeting and Exhibit 2017, Boston, USA, 26 November- 1 December.
104.	in het Panhuis M (2017) Co-organised Symposium BM5: Polymer gels in materials science – 3D/4D printing, fundamentals and applications at the Materials Research Society conference in Boston, USA, 27 – 30 November, http://www.mrs.org/fall2017-symposium-sessions?Code=BM05 .

APPENDIX 8: CONFERENCE PRESENTATIONS BY ACES MEMBERS IN 2017	
105.	Waheed S, Cabot JM, Lewis T, Breadmore MC and Paull B, JM; Macdonald, NP; Breadmore, MC; and Paull, B (2017) 'Three Dimensional Printing with Diamonds', 25th Annual RACI Research & Development Topics Conference, 2017, University of Tasmania, Hobart, Tasmania, 3-6 December.
106.	Goddard E (2017) 'Prosthetics and Disability: Promoting Alternative Ways of Functioning', New Zealand Association of Philosophy Conference, University of Otago, 6 December.
107.	Naquia SA R, Huang XF, Wallace GG, Gilmore K, Crook JM (2017) poster 'Modelling the Effects of Therapeutic Electrical Stimulation mediated by Conductive Polymers on Neurons in Psychiatric Disorders' at 39th Annual Society for Mental Health Research Conference, Canberra, 6-8 December.

Appendix 9: ACES International Events for 2017

APPENDIX 9: ACES INTERNATIONAL EVENTS FOR 2017	WHEN	WHERE
Round Table Discussion on Bionics: ACES & ACES AI Prof Fukuda Yokohama National University, Japan	25 January	iCampus UOW Wollongong
ASAN ACES Workshop: ASAN Medical Center in Seoul, Korea, is the largest hospital in the country, with more than 2,700 beds over 85,000 square metres. ASAN also incorporates a significant research institute which publishes several hundred papers each year. ACES researchers are developing a number of collaborative projects with ASAN in areas including: Printed structures for islet cell regeneration; Printing shaped cartilage structures as noses; Printing vascular systems.	6 February	LKM, UOW
ACES: The Irish Dimension Celebration	7 February	Novotel Wollongong
ACES Electromaterials Symposium: An international conference with an associated 'ACES Showcase'.	8-10 February	iCampus UOW Wollongong
ACES-Yokohama National University Energy & Materials Workshop	11 March	Yokohama University, Japan
UAE-Australia Healthcare Research Symposium: In its fifth year, Australia Unlimited MENA 2017 has an overarching theme of 'Collaborate to Innovate' and will involve participants with expertise in healthcare research, food and agriculture and the mining sector. ACES Director Prof G Wallace was an invited panel member for "Commercialising Innovation: Australian healthcare technologies".	13 March	Dubai
3D Bioprinting workshop at the UOW Dubai campus: Austrade, in collaboration with UOWD, extended invitations to key healthcare customers. The preceding day Prof Wallace was a guest at the Gulf Medical University (GMU) where he had a meeting with healthcare authority followed by visit to the UAE University to meet senior dignitaries and visit the innovation centre.	15 March	UOW Dubai campus
ACES-AMC joint workshop: Printing Parts for Bodies Symposium, Seoul. ACES with Partner Hanyang University organised this event	19 April	Yonsei University, Korea

APPENDIX 9: ACES INTERNATIONAL EVENTS FOR 2017	WHEN	WHERE
Korean ACES Research Showcase: was held at the Australian Embassy in Korea. Representatives from Hanyang University, Gangneung Wonju National University, KIMM, Dongguk University, Seoul National University, Konyang University, Jeju National University, National Research Foundation of Korea, KIST, Yonsei University College of Medicine, ASAN medical centre, Digital Times, The Electronic Times, LG Chem, Samusung SDI, Korea Biotechnology Industry Organization, InfoPia, Bit Computer, I-Sens, Auto Industrial and Samsung electronics were in attendance.	20 April	Seoul, Korea
ACES- DCU 'Beyond Bionics- Converging technologies and emerging opportunities' symposia	25 May	Dublin City University
<p>9th World Congress on Biomimetics, Artificial Muscles and Nano-Bio (BAMN2017): brought together world leading experts to discuss the latest trends, breakthroughs and applications of smart materials for use in soft robotics, biomimetics, medical bionics and wearable technologies.</p> <p>Materials that can sense their surroundings, harvest and store energy and react in appropriate ways are now being combined with advanced processing methods, such as 3D printing, to produce prototype implantable and wearable devices.</p> <p>The biggest impact of these technologies will be in health with applications including implantable devices for soft tissue and organ repair or replacement; controlled drug delivery; prosthetics; wearable robotic garments for rehabilitation; biomimetic systems and many more.</p> <p>Included in the congress was a public engagement session 'Prosthetics of the Future' where Wollongong amputee Len Snowden joined ACES Director Prof Gordon Wallace, ACES Soft Robotics Theme Leader Prof Gursel Alici and ACES Ethics, Policy and Public Engagement Theme Leader Prof Susan Dodds in a public ethics panel discussion about the future of prosthetics.</p>	25- 27 September	iCampus UOW Wollongong
Modelling Building and Interrogating Neural Networks - An ACES event' with Professor Jari Hyttinen from Tampere University of Technology in Finland. His research group has worked on the role of astrocytes in neural network formation.	3 October	iCampus UOW Wollongong
2017 Australia- Biomedical Electronics Translational Research Center (BETRC) Joint Workshop on 3D Bioprint followed by a round table discussion on how to progress collaborative research. From ACES Prof Gordon Wallace gave an overview of 3D printing work, AI Dr Xiao Liu spoke on printing cells and AI Dr Johnson Chung spoke about the research on 3D Printing in Ear Cartilage Regeneration. A new collaborative project will begin in 2018 with a visit from BETRC to ACES planned for March.	18 October	National Chiao Tung University, Hsinchu City, Taiwan
ACES - Institute for Biomedical Sciences Shinshu Workshop on 3D printing for Biomedical Applications 2017. The workshop was held at The Institute for Biomedical Sciences - Interdisciplinary Cluster for Cutting Edge Research of Shinshu University. The target was to establish new links and collaborations with The Institute for Biomedical Sciences. Prof Naoto Saito, Prof Tomohide Takaya and Prof Shin Kadota from Shinshu University introduced their work on 'Carbon nanotube application and safety in artificial joints', 'Novel DNA Aptamer Activating Skeletal Muscle Stem Cells' and 'Cardiac Regeneration Using Pluripotent Stem Cells'.	20 October	Shinshu University, Japan
3D printed microfluidic chip workshop microTAS 2017: ACES members from the Electrofluidics and Diagnostics theme in Tasmania were invited to run this workshop.	22 October	Savannah, U.S.A

Appendix 10: 71 International Academic Visitors to ACES

This list does not include visitors to ACES as part of events or conferences that ACES organised throughout the year.

APPENDIX 10: INTERNATIONAL ACADEMIC VISITORS TO ACES	
1.	Rob Shurko, University of Windsor, Ontario, visited CI Howlett at Deakin University for collaborative research discussions, 24 January.
2.	Dr Stephen Feldberg, Brookhaven Laboratory, USA visited CI Zhang group at Monash University for collaborative research and discussions, February-March.
3.	Professor Michael Deschamps, Université d'Orléans, visited CI Howlett at Deakin University for collaborative research discussions, 6 February.
4.	Sheila Kennedy, MIT, visited CI Howlett at Deakin University for collaborative research discussions, 13 February.
5.	Prof Kevin Bennet, Mayo Clinic, USA visited ACES Deakin Geelong campus, discussing possible work on neural electrodes using carbon fibres, 13 February.
6.	Dr Stephen Feldberg, Brookhaven National Laboratory, visited CI Zhang and AI Bond groups at Monash University for discussion on electrochemical phenomena using computer simulation, 13 February.
7.	Professors Choong Sup Yoon and Jang Myeon Ko from Hanbat national University, Korea, visited ACES UOW for collaborative research discussions, 13-16 February.
8.	Dr Wojciech Domagala, a visiting academic from Silesian University of Technology, Gliwice Poland spent 3 months working with ACES SRF Pawel Wagner at IPRI UOW from 22 February-22 May.
9.	Prof John Terry, Surrey University, UK, visited CI Mark Cook at University of Melbourne, to discuss collaborative research opportunities, February and October.
10.	Ali Mobasheri, BSc ARCS (Hons), MSc, DPhil (Oxon) Professor of Musculoskeletal Physiology, School of Veterinary Medicine, Associate Dean (Research & Enterprise), Faculty of Health & Medical Sciences, University of Surrey visited ACES UOW for collaborative discussions, 24 February.
11.	Dr Stephen Feldberg from Brookhaven Laboratory, USA visited CI Zhang group at ACES Monash University for collaborative research from February to March.
12.	Profs Jie Tang, Kiyoshi Ozawa, postdoctoral fellows Kun Zhang, Xiaoling Yu and PhD students Yige Sun and Jing Li from National Institute for Materials Science (NIMS) visited ACES UOW to discuss energy storage, 3D printing and 2D materials fabrication, 7 March.
13.	Professor Benny Freeman, The University of Texas at Austin, gave a talk titled 'Ion sorption, diffusion and transport in charged polymer membranes', at ACES Deakin, 29 May.
14.	Cynthia Weijers, International Student visited ACES UOW to review the facilities and the research activities, 14 July.
15.	Dr Peter Sherrell, Imperial College London visited ACES Deakin on 26 July.
16.	Associate Professor Ho Seok Park, Samsung Advanced Institute for Health Science & Technolugu, Sungkyunkwan University visited ACES Deakin and gave a seminar 'High temperature flexible supercapacitors using polymer and gel electrolytes' on 27 July.
17.	Prof Phil Bartlett, Southampton University, UK, visited CI Zhang group at Monash University for collaborative research and discussions, 31 July.
18.	Prof Tadaharu Ueda, Kochi University Japan, visited CI Zhang group at Monash University for collaborative research, 31 July -4 August.
19.	Adriana Freites, PhD Candidate Abo Akademi University visited ACES UOW to discuss research opportunities, 1 August.

APPENDIX 10: INTERNATIONAL ACADEMIC VISITORS TO ACES	
20.	Prof Hongge Pan, Mingxia Gao, Yongfeng Liu, Lixin Chen, Xuezhong Xiao from Zhejiang University visited ACES UOW to discuss energy storage and CO ₂ reduction research activities, 2 August.
21.	Professor Gonzalo Cosa, McGill University visited ANU to give a seminar "Chemoselective fluorescence imaging of nucleophiles, ROS and redox processes: from high throughput to single particle to single molecule events" and discuss research, 2 August.
22.	Dr Hongzhou Zhang, Tianjin University of Technology visited ACES UOW to discuss energy storage and CO ₂ reduction research activities, 7 August.
23.	Prof Patricia Gray, Leeds University, visited ACES Deakin, to discuss research training, 15 August.
24.	A/Prof Liang Shao, China is working at ACES UOW for 18 months on the development of tough gel based electrodes for novel batteries or supercapacitors, from 27 August.
25.	Dr Rawiwan Laocharoensuk, Dr Annop Klamchuen, Dr Thanh-Binh Duong-Au, Dr Sasitorn Aueviriyavit, Ms Benyapa Suwan, Professor Siwaporn Meejoo Smith, Emeritus Professor Tony Moon, National Nanotechnology Centre, National Science and Technology Development Agency, Khlong Nueng, Khlong Luang, Pathum Thani Thailand visited ACES UOW to explore collaboration possibilities, 13 September.
26.	A/Prof Edwin Jager, Linkoping University, Sweden, visited CI Geoff Spinks at IPRI to undertake collaborative research activities at UOW from 28 September - 4 October.
27.	Dr Bert Wouters (CASSS Frantisek Svec Fellowship for Innovative Studies) from Peter Schoenmakers Group at the University of Amsterdam, visited ACES at UTAS to discuss fabrication of 3D printed glass (silica polymer composite) devices, 3 October - 3 November.
28.	Dr Andrew Vogt, SCION New Zealand visited ANU to discuss potential collaborative research projects (funded by an NZRS Catalyst Grant awarded to Scion), 10-12 October.
29.	Dr Manlin Li, College of Chemistry and Pharmacy, Northwest A & F University, P.R.China, to work at ACES UOW for 12 months as a visiting fellow, from November 2017.
30.	William E. Price, Chief Operating Officer, Stem Cultures, Rensselaer, New York, USA Industry collaborator visited ACES UOW, 4 October.
31.	Prof Xu Qun from College of Materials Science and Engineering, Zhengzhou University, Zhengzhou, Henan, China visited CI Chen at ACES UOW to work on collaborative projects, from 20 November- 20 December.
32.	Prof Jari Hyttinen, Tampere University of Technology, Finland, visited ACES UOW from 4 October-20 December.
33.	Dr Amita Chandra, University of Delhi, India spent 3 days at ACES Deakin discussing 'Indian women in Science: Some facts & some points to ponder', 6-9 November.
34.	Dr Sangeeta Negi, University of Delhi, India, visited ACES Deakin to discuss research and give a lecture on 'Selective cation transportation through polymeric membrane', 6-10 November.
35.	Dr N. Rajalakshmi, Advanced Research Centre International for powder metallurgy and new materials, Chennai, India, visited ACES Deakin to discuss research and give a lecture on 'Sustainable and Green energy from Electrochemistry-Fuel cells perspective', 6-10 November.
36.	Dr Vinita Gupta, Bhabha Atomic Research Centre, Mumbai, India, visited ACES Deakin to discuss research and give a lecture on 'Advanced ceramics for energy applications: Structure-functionality relationship', 6-10 November.
37.	Riccardo Levato & Khoon Lim, postdoctoral researchers from University Medical Centre & University of Utrecht and Otago, visited ACES at UOW to review progress of the BIOFab masters students for one week, from 10 November.
38.	Xi'an, Northwestern Polytechnical University, China, visited ACES Deakin to discuss research, 14 November.

APPENDIX 10: INTERNATIONAL ACADEMIC VISITORS TO ACES	
39.	Prof Jari Hyttinen, Tampere University of Technology, Finland, visited ACES UOM at St Vincent's hospital, 25-27 November.
40.	Prof Jinson Leng, Director of Centre for Smart Materials & Structures at Harbin Institute of Technology, visited ACES at UOW to discuss potential research collaborations, 5 December.
41.	Prof Mohamed Salem, President at University of Wollongong Dubai, visited ACES at UOW to discuss master program options and progress, 7 December.
42.	Prof Brian Litt, University of Pennsylvania, visited CI Mark Cook at University of Melbourne, to discuss collaborative research opportunities in neuro engineering, December.
43.	Dame Bridget Ogilvie, IAC chair visited ACES UOW to discuss progress, 20 December.
44.	Prof Louis Lemieux, UCL Institute of Neurology in London, visited ACES Melbourne and UOW for collaborative research discussions around graphene composites and fabrication, 19- 22 December.
STUDENT VISITORS	
45.	Yunfeng Chao, a CSC scholarship recipient, is with ACES at UOW for 3 years working on 'Fabrication of graphene structures for energy storage using roll-to-roll printing'.
46.	Zan Lu was at ACES UOW on a 18-month CSC scholarship from January 2016 on 'Mechanical-Electrical Properties of Carbon Nanotube Yarns and Applications in Smart Textiles'.
47.	Kezhong Wang, a recipient of a 12-month CSC scholarship, spent 2016 in ACES at UOW working on wet spinning graphene fibers. *In September 2017 Kezhong began his PhD with ACES UOW.
48.	Rachel Waldrom, an undergraduate student from Cardiff University in Wales, spent 9 months at ACES UOW, from 1 August 2016, working on graphene nanocomposites for photo-electrocatalytic water treatment.
49.	Yuka Shimazu from ACES partner Yokohama National University worked at ACES UOW between 25 September 2016 and 5 February 2017 on fabrication of a double layered vessel structure.
50.	Sarah-Sophia Carter, Biofabrication Masters student from Utrecht University spent ten months at ACES UOW completing the second year project of the dual degree, from September 2016. Her work involved three dimensional islet cell printing; including a 3 week stay with ACES collaborators Prof Toby Coates at Adelaide hospital.
51.	Sylvia Van Kogelenberg, Biofabrication Masters student from Utrecht University in Netherlands spent ten months at ACES UOW completing the second year of the dual degree, from September 2016. Silvia's project involved creating a printable polymer suitable for fibroblastic cell growth, and providing an optimal microclimate and delivering small molecule modulators to enhance the wound healing process.
52.	Linda Abbassi, Université de Montpellier, France spent six months, 16 January-28 July, working on her project 'development of novel plastic crystal-based membranes for gas separation' at ACES Deakin University.
53.	Jordan Joel, visiting undergraduate working with CI Jun Chen at ACES UOW for 9 months from January 2017.
54.	DCU postgraduate student Eoin Murray, working with ACES AI Morrin, spent 3 months at ACES UTAS node working on portable chromatographic systems for nutrient monitoring, Jan-March.
55.	Mr Akihiro Tuchiya, a visiting student from Shinshu University, Ueda Japan, spent two months working with ACES SRF Pawel Wagner at IPRI UOW from 1 March-31 April.
56.	Maxim Brodmerkel, Wurzburg University in Germany, spent ten months at ACES UOW completing the second year of the dual degree, from July 2017.
57.	Juliane Kade, Wurzburg University in Germany, spent ten months at ACES UOW completing the second year of the dual degree, from July 2017.

APPENDIX 10: INTERNATIONAL ACADEMIC VISITORS TO ACES	
58.	Marius Berthel, Wurzburg University in Germany, spent ten months at ACES UOW completing the second year of the dual degree, from July 2017.
59.	Mr Valentin Fell, a visiting student from Strathclyde University, Glasgow UK worked with ACES SRF Pawel Wagner at IPRI UOW from 14 August-8 December.
60.	Rhiannon Morris, School of Chemistry, Cardiff, UK, is working with CI in het Panhuis at IPRI UOW, 20 August 2017-1 May 2018.
61.	Itziar Aldalur Ceberio from CIC EnergiGUNE, Spain spent four months, 25 August-3 December, working on the project 'highly conductive Jeffamine® based polymer electrolytes as alternative materials in battery application' at ACES Deakin University.
62.	Bing Lin, Beijing University of Chemical Technology, China is a visiting student at ACES Deakin from 25 September.
63.	Diego Castañeda Garay, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
64.	Stefan Zaharievski, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
65.	Laura Blanco Peña, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
66.	Max Renes, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
67.	Gilles van Tienderen, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
68.	Gregor Weisgrab, Utrecht University in Netherlands, spent ten months at ACES UOW completing the second year of the dual degree, from September 2017.
69.	Xiaomin Zhang from Nanjing University, China is being hosted on a postgraduate research exchange at ACES Monash University from 29 September 2016 through to 3 March 2018.
70.	Fleurine Eberle from Wurzburg University, Germany was hosted at ACES UOW to undertake 6 months of her masters thesis working on metal 3D printing from 1 October 2017 to 31 March 2018.
71.	Subhra Gope, Indian Institute of Science (IISc), Bangalore, India studied at ACES Deakin on Novel Cathode Materials for Li-S batteries from 6-25 November.

Appendix 11: National Academic Visitors to ACES

This list does not include visitors to ACES as part of events or conferences that ACES organised throughout the year.

APPENDIX 11: NATIONAL ACADEMIC VISITORS TO ACES	
1.	Sutton, G and Cooper S, Sydney Eye Hospital, visited UOW ACES to progress the collaborative work on corneal bioengineering project 12 January 2017.
2.	Sharon Robinson, Associate Dean Graduate Research Research & Innovation Division, Co-Director Centre for Sustainable Ecosystem Solutions School of Biological Sciences Univeirsty of Wollongong visited ACES UOW to discuss collaborative research opportunities, 18 January.
3.	Dr Martin Engel, Associate Research Fellow, Neuroscience Ooi Laboratory, Illawarra Health and Medical Research Institute (IHMRI), University of Wollongong spent 2 days working with ACES UOW members, 24-25 January.
4.	Enrico Della Gaspera, RMIT University, visited ACES Deakin to review facilities and discuss research opportunities, 25 January.
5.	Hocking, Rosalie visited Monash University to collaborate on making of a gastight electrochemical cell coupled with X-ray spectroscopy (XANES, EXAFS) for in situ characterisation. In-situ XANES, EXAFs measurement of Cobalt catalytic films for oxygen evolution was undertaken at the Australian Synchrotron with ACES members Alexandr Simonov and Mandjunath Chatti, 13-17 February 2017.
6.	Crook, J and Tomaskovic-Crook E, (2017) visited by Prof Richard Banati; A/Prof Guo-Jun Liu; Dr Ryan Middleton; Ms Wadha Alyami for discussion regarding ANSTO collaboration, 24 March 2017.
7.	Professor Peter Talbot, Queensland University of Technology, visited ACES Deakin and BatTRIhub to review facilities and discuss research opportunities, 31 March.
8.	Antoine van Oijen, UOW Chemistry visited ACES UOW for an ARC Centre of Excellence strategic discussion, 4 April.
9.	Ryuichi Murase, PhD student in the D'Alessandro group, University of Sydney visited ACES UOW to learn FT simulation, 6 April.
10.	Prof Jim Hill, University of South Australia and Dr Ngamta Thamwattana, Univeristy of Wollongong, visited ACES UOW to discuss potential collaborative projects, 13 April.
11.	Erin McColl visited ACES UOW to view the facilities and research with a view to employment at UOW, 28 April.
12.	Tim Scott MD Royal North Shore Hospital visited ACES UOW to give a seminar and discuss progress in the soft robotics area for future collaboration, 28 April.
13.	David Nisbett, ANU, visited ACES UOM /St Vincents Hospital Melbourne for collaborative discussions, 2 May.
14.	John Andrews, RMIT University, visited ACES Deakin to review facilities and discuss research project, 8 May.
15.	Jo Law, Senior Lecturer Faculty of Law, Humanities and the Arts at University of Wollongong researching in the areas of art, media and technology and her colleague Dr Agnieszka Golda, Senior Lecturer with research expertise in textiles and fibre art, visted ACES UOW giving a seminar and holding collaborative discussions, 11 May.
16.	A/Prof Adam from Laser Chemistry Laboratory, School of Chemistry, University of Wollongong, gave a seminar and held collaborative discussions at ACES UOW , 19 May.
17.	Prof Justin Gooding, University of New South Wales, visited ACES UOW to give a seminar and have research discussions, 2 June.
18.	Dr Gail Iles, RMIT University, visited ACES Deakin to review facilities and give a talk 'Condensed Matter Research – Systems and Characterisation', 14 June.
19.	Jingzeng You, Save Sight Institute, University of Sydney visited ACES UOW to undertake research activities, 13 July.

APPENDIX 11: NATIONAL ACADEMIC VISITORS TO ACES	
20.	Wang, Caiyun (2017) hosted Dr Sihuang Xie from School of mining and engineering at UOW in ACES to discuss microbial fuel cells, 21 July.
21.	Prof Huijun Zhao, from Griffith University, visited Monash University to discuss collaborative projects with CI Zhang and RF Si-Xuan Guo, 21 July.
22.	Kod Pjtanabuntoeng, Curtin University, to tour Deakin University lab facilities, 28 July.
23.	Prof Phil Bartlett, University of South Hampton, visited Monash University to discuss collaborative projects, 31 July.
24.	Paul Atkin, PhD student RMIT University visited ACES at UOW to give a seminar and look for future research opportunities, 11 August.
25.	Dr David Garrett and Dr Nick Apollo, University of Melbourne, visited ACES Geelong Node to conduct electrochemical testing on neural electrodes, 15 August.
26.	Dr Rahim Mutlu (Lecturer MECH482/919 subjects) and 15 students enrolled in MECH482/919 at UOW visited ACES at UOW to be introduced to the facilities and capabilities, 25 August.
27.	Dr David Elliott, Group Leader, Murdoch Children's Research Institute, visited ACES at UOW to review the facilities and research activities, 9 September.
28.	Prof Gerard Sutton, Jingjing You, Hannah Frazer from Sydney Eye Bank at UOW to perform mechanical testing of materials and discuss the collaborative research direction regarding development of iFixPen, 15 September.
29.	A/Prof Chuan Zhao, PhD student Wanfeng Yang, PhD student Chen Jia
30.	Dr Michael Morris, Group Leader, School of Medical Sciences, Bosch Institute and University of Sydney visited ACES UOW, 22 September
31.	Ryuichi Murase, PhD student in the D'Alessandro group, University of Sydney visited ACES UOW to continue with learning FT AC simulations, 13 October.
32.	Nicky Thomas, NHMRC Fellow UniSA, visited ACES at UOW to discuss collaboration targeting biofilms, 23 October.
33.	Mia Woodruff, Director QUT Herston Biofabrication Institute, was hosted at ACES UOM/St Vincent's Hospital Melbourne to review facilities and discuss collaborative opportunities, 15 November.
34.	Prof Brian Dean, Head of the Molecular Psychiatry Laboratory, The Centre for Mental Health, Deputy Director, The Victorian Brain bank Network, Swinburne University, The Florey Institute of Neuroscience and Mental Health visited ACES at UOW to discuss collaborative funding applications, 27 November.
35.	Trevor Rapson (Research Scientist), Tara Sutherland (Team Leader) and Guanyu Liu (Postdoc) from CSIRO visited ACES at UOW to give a seminar and discuss ways to manufacture silk electrodes, 15 December.



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ARC Centre of Excellence for Electromaterials Science
University of Wollongong, Innovation Campus
North Wollongong NSW 2500 Australia
+61 2 4221 3127
www.electromaterials.edu.au

University of Wollongong
Deakin University
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