MACQUARIE University

FACULTY OF SCIENCE AND ENGINEERING

July 2018

Suggest a story >

From the Dean

NEWSLETTER | JULY ISSUE

Dear Suzannah

Imagine an electronic device the size of a single molecule. Or drug-filled nano-bubbles which can deliver an anti-cancer drug exactly where it is needed in the body. Far from being science fiction, these are research projects members of our Faculty are working on right now. In this edition of the newsletter you can also read about how Macquarie is playing a key role in a citizen science project to map microplastic pollution.

I'd like to congratulate the first graduates of our Entrepreneurial Enrichment PhD Program. It was inspiring to listen to their final presentations earlier this month and I'm excited to see where their projects will take them next. Congratulations are also due to Biology's Jenny Donald who was awarded the Genetics Society of AustralAsia's Award for Excellence in Education at their recent annual meeting.

This month also saw new beginnings for the Australian Proteome Analysis Facility which is now part of the Department of Molecular Sciences. The Department of Earth and Planetary Sciences hosted Geoanalysis 2018, an international conference with 150 attendees, which helped raise the profile of our university and the Macquarie GeoAnalytical lab. And the Department of Computing ran a very successful hackathon, with more than 100 people taking part.

A really exciting and significant new beginning for the Faculty happened this month, with the School of Engineering completing the first phase of its off-campus expansion, as it opens its new world-class research and teaching facilities at 44 Waterloo Road, Macquarie Park. Engineering has also officially opened the Macquarie and Analog Devices Teaching and Research Laboratory, a partnership between us and semiconductor company Analog Devices to meet the demands of the new wireless revolution.

Finally, my congratulations to Environmental Sciences' Neil Saintilan who is a Eureka Prize finalist for Outstanding Mentor of Young Researchers. Neil is mentoring young researchers and helping them solve pressing environmental problems by building a more effective interface between science, policy and management.

I'd also like to extend my congratulations to the three finalists for the Macquarie University Eureka Prize for Outstanding Early Career Researcher. Dr Caitlin Byrt, from

the University of Adelaide, has identified sodium transport genes to produce salt tolerant crops that are better adapted to changing environments. Dr Justin Chalker, from Flinders University, is converting waste cooking oil and sulfur into a polymer that can clean up oil spills and capture toxic mercury pollution. And Dr Mohsen Rahmani, from the Australian National University, has developed a new class of nanoscale surfaces. His research could be used in night-vision technology, adjustable lenses and ultra-sensitive biochemical detectors. The winners of the Eurekas will be announced on 29 August.

And in breaking news, congratulations to Molecular Sciences' Andrew Piggott and his team who will join forces with UWA scientists and two Australian companies to search for new antibiotics in 500,000 species of Australian microbes. Their project will be supported by a $3 million CRC-P grant announced by Australia's Assistant Minister for Science, Jobs and Innovation, Senator Zed Seselja yesterday. We'll bring you more on that story in the next edition of the newsletter.

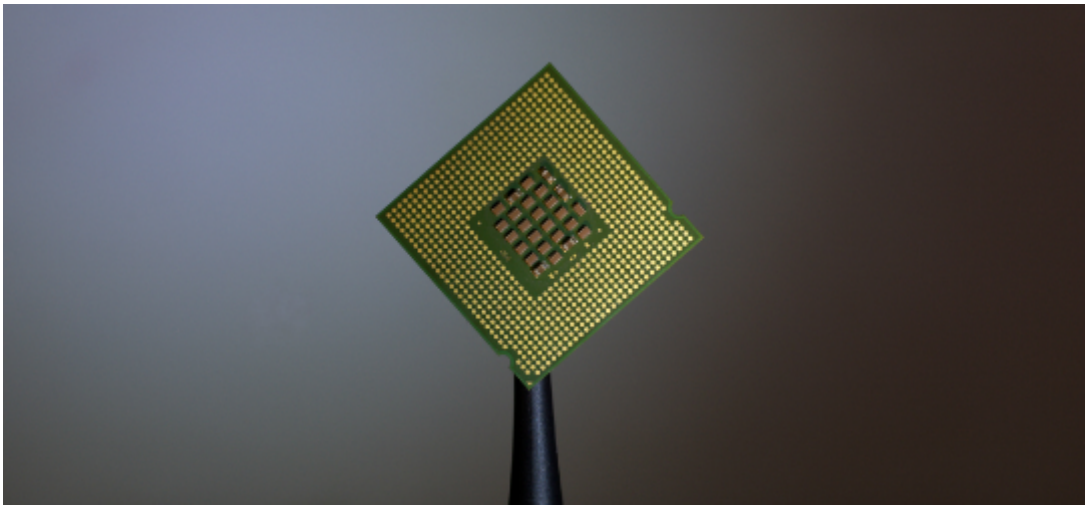
If you want to know more about what's happening across the Faculty, follow our Faculty Twitter account @MQSciEng and my personal account @BarbaraMesserle. If you've got news to share, please tweet about it and include our Faculty handle so we can see it and retweet. If you're not on Twitter, then email us at fse.execdean@mq.edu.au and we'll share the news.

Regards,

Barbara

In this bulletin

The future of electronics is chemical



We can't cram any more processing power into silicon-based computer chips.

But a paper published in *Nature* earlier this month reveals how we can make electronic devices 10 times smaller, and use molecules to build electronic circuits instead.

We're reaching the limits of what we can do with conventional silicon semiconductors. In order for electronic components to continue getting smaller we need a new approach.

Molecular electronics, which aims to use molecules to build electronic devices, could be the answer.

But until now, scientists haven't been able to make a stable device platform for these molecules to sit inside which could reliably connect with the molecules, exploit their ability to respond to a current, and be easily mass-produced.

An international team of researchers, including Molecular Sciences' Koushik Venkatesan, have developed a proof-of-concept device that they say addresses all these issues.

The team exploited the fact that metallic nanoparticles can provide reliable electrical contacts to individual molecules, allowing them to transport charge through a circuit.

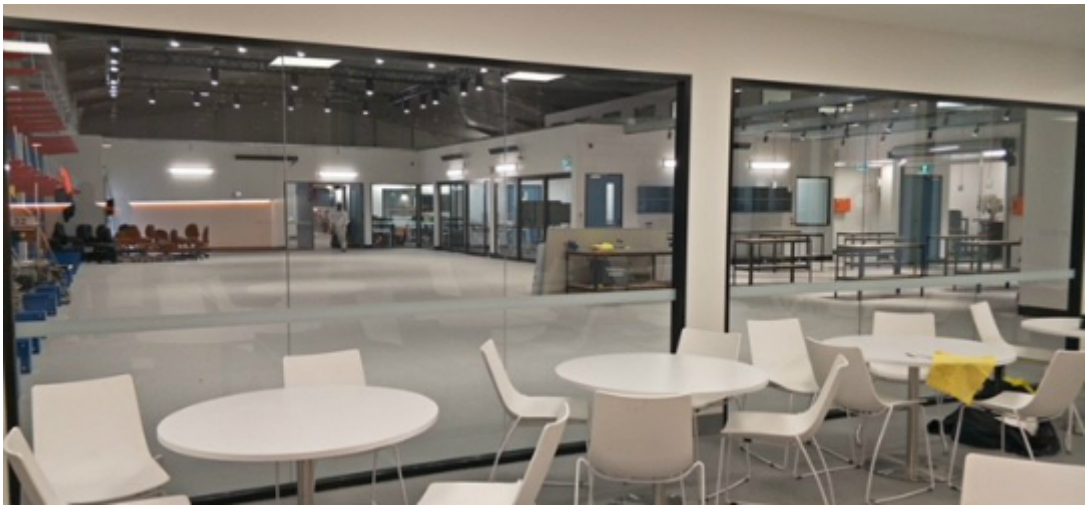
Their next goal will be to test the platform with different molecules that have different functions to see if they can make it work.

If successful, their technique could lead to molecular compounds being integrated into solid-state devices that could be scaled down to the size of a single molecule.

Find out more

Photo by Brian Kostiuk.

The School of Engineering is on the move



The School of Engineering has completed the first phase of its off-campus expansion, as it opens its new research and teaching facilities.

In this initial phase, we have moved some staff and students across into purpose-built teaching, research laboratory and office facilities at 44 Waterloo Road, Macquarie Park.

Research facilities include a wind tunnel for fluid dynamics research, a mechanical 3D printer and furnace, facilities for high power electrical research, and growth space for new incoming staff.

The new location will allow space for teaching in the areas of electrical and high power electrical, future networks and software-defined networking, mechanical group projects and robotics.

There is space for students to work on their fourth-year thesis projects, and space for individuals and teams to imagine, plan and design, and create and build their inventions. In terms of outreach, FIRST Robotics will now have a full test field site.

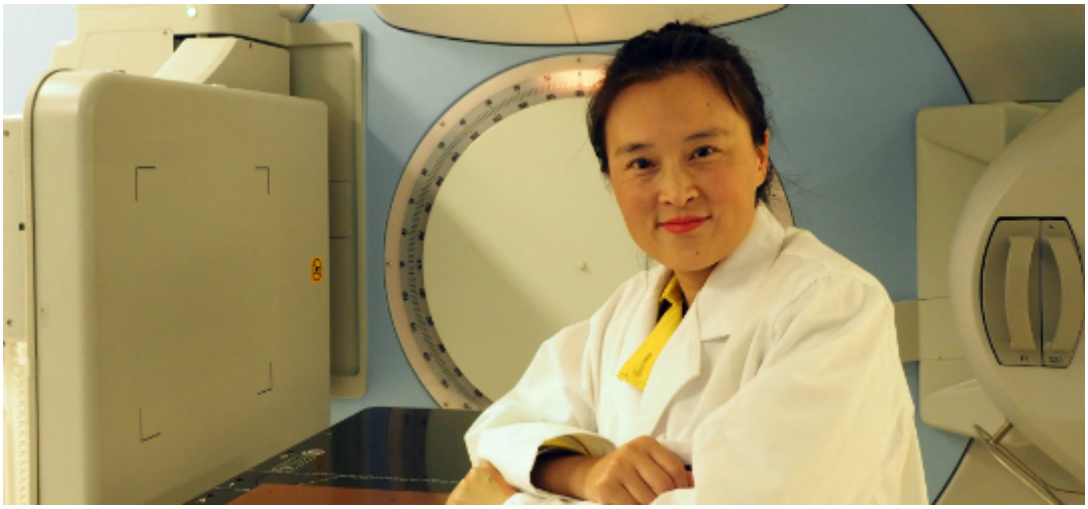
In the second phase of the move later this year, Engineering will occupy space at 50 Waterloo Road as well, thereby creating a Macquarie University satellite precinct in the local business district and within close reach of the main campus.

The move is for four to five years while a new Engineering facility is being built on the main campus.

Frequently asked questions about the move

If you have any other questions about the move, please contact fse.engg-feedback@mq.edu.au.

X-ray triggered nano-bubbles to target cancer



Innovative drug filled nano-bubbles, able to be successfully triggered in the body by X-rays, are paving the way for a new range of cancer treatments for patients.

The tiny bubbles, known as liposomes, are commonly used in pharmacology to encapsulate drugs, making them more effective in the treatment of disease.

Researchers have now been able to engineer these liposomes to discharge their drug cargo on-demand, once activated by standard X-rays. Initial testing has shown this technique to be highly efficient in killing bowel cancer cells.

“The development and application of various nanomaterial designs for drug delivery is currently a key focus area in nanomedicine,” says lead author of the research Wei Deng from Physics and Astronomy, who is an associate investigator at the ARC Centre of Excellence for Nanoscale BioPhotonics.

“Liposomes are already well-established as an extremely effective drug delivery system.

“Made out of similar material as cell membranes, these ‘bubbles’ are relatively simple to prepare, can be filled with appropriate medications and then injected into specific parts of the body. The issue however, is in controlling the timely release of the drug from the liposome.

“We have ensured that the liposomes release their drug payload at exactly the right time and in exactly the right place to ensure the most effective treatment.

“The approach we took was to embed gold nanoparticles and the photo-sensitive molecule verteporfin into the wall of the liposome.

“The radiation from the X-ray causes the verteporfin to react and to produce highly reactive singlet oxygen which then destabilises the liposomal membrane, causing the release of the drug,” she says.

Their research was published in *Nature Communications*.

Find out more

Citizen science to put microplastics on the map

Macquarie is playing a key role in a citizen science project to document the microplastic pollution along our coasts and waterways, which was launched earlier this month.

The Australian Microplastic Assessment Project, or AUSMAP, is a collective of research, education, business and not-for-profit groups engaging schools and community organisations nationwide to raise awareness of plastic pollution and help identify microplastic hotspots.

We're the lead research institute providing the scientific oversight for the project. Environmental Sciences' Scott Wilson has led the program design, sampling methodology, data analysis and quality assurance for the project.

"As an ecotoxicologist I've been studying the impacts of a range of contaminants on aquatic systems over the last 20 years," he says.

"With the current level of plastic waste and litter in our environment, my current focus is understanding the impacts that plastics are having.

"Currently, there is little information on microplastics in Australia.

"Through AUSMAP and a citizen science approach we can fill knowledge gaps that will allow for more informed management of plastic pollution at both the local and national level."

Find out how you can get involved

From PhD candidates to budding entrepreneurs

Congratulations to the first graduates of our Entrepreneurial Enrichment PhD Program (EEPP).

Over the last six months they have used their research ideas to help design and develop their own start-ups, while being mentored by social entrepreneurs Dorjee Sun and Selena Griffith.

The purpose of the program is to help the PhD candidates identify both the financial opportunities and social impact potential of their work.

Earlier this month, the seven teams gave their final presentations as part of the inaugural EEPP.

There was a high level of success among the cohort in gaining internal and external support, including financial investment in their projects.

All seven teams produced fully-working prototypes during the program. Three teams have reached commercialisation, with a further three ready to be commercialised after they've submitted their PhDs.

It's also great to hear the students' feedback after going through the program. Here is a small selection of their comments:

"I was very interested in enterprise-building, and wanted to develop the skills required for building a company and bringing in investments. This program helped me achieve both."

"A much wider way of thinking, rather than the narrow approach of academia."

"This is the most wonderful program I have seen so far. It's too practical and in the real world. It's a program that everyone should apply for."

"EEPP is not only about entrepreneurship, it's more. It's about facing challenges in life with courage, determination and focus. It's more philosophical than academic."

"Now that we have got investment in the company, we have already started to develop a research lab in India with industry funds. We have started mass production of the product. We have started developing new products too. We will be starting sales in October."

Education award for genetics guru

Congratulations to Biology's Jenny Donald who was awarded the Genetics Society of AustralAsia's (GSA) Award for Excellence in Education at their recent annual meeting.

The award recognises: Jenny's genetics teaching; her support and fostering of undergraduate students through implementing programs to proactively monitor their progress and mentoring their academic advisors that are highly regarded across the university; and her leadership in curricula development.

For many years Jenny also looked after scholarships the GSA awarded to undergraduate students to attend their annual conference. This involved assessing application, liaising with the students and mentoring them at the conference.

At the meeting Jenny gave a talk entitled 'Helping our undergraduate students think like scientists', where she spoke about how she helps her students dissect scientific papers, by giving them little bits of a paper to explain at a time. This approach helps them break the paper down and really understand what it's about, and when used in a first year biology unit led to much improved results in how the students performed in the assessment.

Well done Jenny on a richly-deserved honour.

New beginnings for Australian Proteome Analysis Facility

In exciting news, the newly restructured Australian Proteome Analysis Facility (APAF) is now part of the Department of Molecular Sciences.

“We’re aiming to offer more innovative services and greater opportunities to collaborate within the Faculty and University,” says Molecular Sciences’ Mehdi Mirzaei, who is the Scientific Director of the facility.

“Our current major users on campus are the Faculty of Medicine and Health Sciences and the Department of Molecular Sciences within FSE, but we would gladly welcome the initiation of new projects and collaborations from all departments across the Faculty.”

In particular, APAF is calling for collaborative projects within the faculty in targeted metabolomics, small molecule analysis and metaproteomics.

The facility’s mission is fourfold: to provide cutting-edge and affordable proteomics and protein characterization services; to provide education, training and support to clients and collaborators from experiment design to data interpretation, including for publications and grant proposals; to offer proof-of-concept small-scale experiments with a minimum fee (an excellent approach for generating preliminary data for grant applications); and to continually innovate on existing technologies.

APAF’s laboratories house 16 high-end mass spectrometers, and the protein chemistry lab has various high-performance liquid chromatography capabilities.

The facility is comprised of three units: Mass Spectrometry, Bioinformatics, and Protein Chemistry and Array Technologies; and is supported by the scientific and technical expertise of 15 staff.

For more information about the services APAF offers go to the APAF website or contact info.apaf@mq.edu.au.

Conference highlights our strengths in geoanalysis

Macquarie was proud to host Geoanalysis 2018, the 10th triennial scientific meeting of The International Association of Geoanalysts, on campus earlier this month.

The conference was attended by 150 delegates, 40 per cent of whom came from overseas, and was sponsored by 15 companies.

As well as providing excellent scientific and social programs, and very successful field trips, the meeting was also an opportunity to introduce our colleagues to Macquarie GeoAnalytical (MQGA).

MQGA is one of the best and biggest geoanalytical laboratories in the Southern Hemisphere, and the only such laboratory in the Sydney Basin. Major breakthroughs in geoanalytical methods have come from this laboratory.

“For many of our colleagues it was the first time that they were visiting the laboratory and they were quite impressed with our combination of state-of-the-art equipment,” says Earth and Planetary Sciences’ Dorrit Jacob, who was the chair of the Geoanalysis 2018 organising committee.

“We are hoping for increased exchange of students and colleagues, and generally rejuvenated contacts and networks as an effect of this meeting.”

Find out more

Hackathon draws crowds

More than 100 people participated in the Department of Computing's first hackathon, held earlier this month.

Run by the Big Data Society and Data Analytics Research Group the three-day event attracted staff, undergraduate and postgraduate students from Macquarie, and students from UNSW, UTS and USyd.

Participants were challenged to find ways to analyse the big data generated on social networks to save lives, including proactively detecting patterns of suicidal thoughts or cyberbullying.

Congratulations to Cameron Pappas, Michael Lay, Daniel Sutantyo, Joseph Hardman, Katie Wang, Seyed Mohssen Ghafari, Shahpar Yakhchi and Desnica Kumar who won the challenges.

Participants also got to attend talks and workshops given by academic and industry leaders, looking at the topics covered in the challenges.

Our thanks to the event sponsors: SAS, Yellowfin, Microsoft and Engenesis.

Find out more about the event

After the success of this event the Big Data Society is already planning their next hackathon, to be held in September.

Update: New engineering lab opens

In the May edition of the newsletter we told you about the School of Engineering's partnership with semiconductor company Analog Devices to launch the Macquarie and Analog Devices Teaching and Research Laboratory (MADTRL).

Designed to meet the demands of the new wireless revolution, the lab was officially opened last week.

"This partnership will allow us to fully integrate 'real world' industry experience into undergraduate and postgraduate education, moving away from the traditional separation of classroom theory and laboratory exercises from industry placements and internships," says Engineering's Michael Heimlich.

Find out more

Research in tweets

We've been sharing snippets of our recently published research and Faculty members being mentioned in the media on Twitter.

Here are some recent highlights from @MQSciEng.

Congratulations to @EnvScMQ's Neil Saintilan who is a #Eureka18 finalist for Outstanding Mentor of Young Researchers. Good luck Neil! (And in Neil's video you might spot a cameo from one of our #Eureka17 winners @EmilieEns) QT @eurekaprizes: Professor Neil Saintilan @saintilann from @envscMQ @MQ_Marine @Macquarie_Uni is a finalist in the 2018 @UTSEngage Eureka Prize for Outstanding Mentor of Young Researchers.

"Unless drastic action is taken, extreme coral bleaching will be the new normal by the 2030s," warns @MQBiology's Lesley Hughes

How to grow crops on Mars if we are to live on the red planet, by @MQMolSci's Briardo Llorente QT @shelleymiranda: "The recent discovery of liquid water on Mars – which adds new information to the question of whether we will find life on the planet – does raise the possibility of using such supplies to help grow food."

RT @MQPhysAstro: Read all about tomorrow morning's lunar eclipse with an article from @MQPhysAstro Professor Richard de Grijs @tallstarman. Set your alarm for an early wake-up! @MQSciEng QT @tallstarman: Read about tomorrow morning's total lunar eclipse in a bite-sized explanation @MQSciEng: Sydneysiders, you have to wake up early as totality starts around 05:30am!!

Read @brucefschaefer's full comments @MqEPS QT @Macquarie_Uni: Today's news of the discovery of a large lake on Mars "ranks as one of the most exciting developments in planetary exploration in recent years." - Associate Professor @brucefschaefer from the Department of Earth and Planetary Sciences @MQSciEng

"As slime molds don't have any neurons, the mechanisms of the learning process must be completely different; however, the outcome & functional significance are the same," says @MQBiology's @ChrisRReid1 QT @SciTech_Cat: Slime molds and plants can learn - *without* a brain. Researchers are still trying to figure out what this 'primitive cognition' is all about and how it actually works Read the article

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Faculty bulletin

New staff | Associate Dean of Industry and Corporate Engagement | Other vacancies | AIP Women in Physics public lecture | Sparking sustainability public forum | AMSI-SSA specialist lecture

Welcome to new Faculty staff

A warm welcome to all the new staff who have joined the Faculty within the past month.

Please join me in welcoming **Ashley Wheeler** and **Jenny Fang** who are the new administrator and outreach coordinators for Chiropractic, and Environmental Sciences and Earth and Planetary Sciences respectively. Ashley previously worked for the READ Clinic and Jenny was at Doltone House.

Rob Hend is a project coordinator for the Faculty. He joins us from UNSW.

Jaco Le Roux is an associate professor with Biology, and joins Macquarie from Stellenbosch University in South Africa.

Nicole Mealing is a Statistics lecturer from Western Sydney University.

Agni Amarnath is a scientific officer with Molecular Sciences and joins us after undertaking an internship at Macquarie.

And welcome to all the new AAO staff who have joined us recently: **Nuwanthika Fernando, Sufyan Baker, Gabriella Baker, Norrie Bennie, Mike Birchall, Rebecca Brown, Jurek Brzeski, Scott Case, Timothy Chin, Vladimir Churilov, Gayandhi De Silva, Simon Ellis, Tony Farrell, Peter Gillingham, Michael Goodwin, Lloyd Harischandra, Urs Klauser, Yevgen Kripak, Kyler Kuehn, Neville Legg, Nuria**

Lorente, Slavko Mali, Elizabeth Mannering, Mahesh Mohanan, Rolf Muller, Vijay Nichani, Simon O'Toole, Naveen Pai, Gordon Robertson, Will Saunders, Scott Smedley, Sudharshan Venkatesan, Minh Vuong, Lew Waller, Helen Woods, Tayyaba Zafar, Ross Zhelem and **Jessica Zheng**.

Vacancy for an Associate Dean of Industry and Corporate Engagement

The Executive Dean of Science and Engineering is currently recruiting for an Associate Dean of Industry and Corporate Engagement. This senior academic role (Professor or Associate Professor level, with a salary loading) is supported by FSE's Engagement Manager, Louise McDonald, and reports to the Faculty Executive Dean, Professor Barbara Messerle.

The Associate Dean of Industry and Corporate Engagement will lead the development and execution of strategy for growing the Faculty's relationships with industry and corporate engagement partners. The successful applicant will have responsibility for developing and enhancing a culture of external engagement and building the capability of staff across the Faculty in undertaking research and the translation of research in collaboration with external partners. They will work closely with our academic staff across the Faculty and develop the capability of the staff in their competence and confidence in engagement activities.

As a member of the Faculty's senior academic leadership team, they will be able to develop productive, long term partnerships with corporate, industry and government networks and across disciplines in Australia. They will be expected to have a strong scholarship and research background in a related Science and Engineering discipline, along with industry and partnership experience.

To find out more about the role and to apply follow this link.

Other vacancies

We're looking for two postdoctoral research fellows to lead research into natural language processing, computer vision and/or dialog with the Department of Computing.

We have an exciting opportunity for a research fellow in wireless communications to work on a joint ARC project on mm-wave mobile broadband communications.

And we are seeking one postdoctoral fellow to join a team of talented world-renowned researchers to work on different aspects of distributed algorithms in dynamic networks.

AIP Women in Physics public lecture: Pressing FIRE on the most powerful laser in the world

In association with the Australian Institute of Physics and the Sydney Science Festival, join us on **Wednesday 8 August** for a fascinating public lecture by plasma physicist Dr Ceri Brenner.

When we press FIRE on the most powerful laser in the world, we deliver a packet of light that is a thousand billion billion times more intense than the sunlight you feel while

out on Bondi Beach in peak summer! That's super intense!

But what makes these lasers really super is that we're using them to turn research into real applications that will improve our future. From igniting a miniature star on earth to keep our power stations working for thousands of years with clean fuel, to designing micro accelerator beams for detecting and zapping away cancer or even taking a snapshot photo of a jet engine at full speed.

Dr Ceri Brenner is a physicist using the most powerful lasers in the world to develop innovative imaging technology for medical, nuclear and aerospace inspection. Register for the event.

Sparking sustainability public forum

Hear the ideas and experiences of school teachers and Macquarie University preservice education students who have been involved in a project to stimulate sustainability education in primary schools. They will present their work at a public forum at the Incubator on **Thursday 16 August**, from 6-8pm.

The forum hopes to encourage other teachers to embrace sustainability and we would like to invite the primary teachers of staff's children—so please pass on the invite to them!

This event is part of an inter-faculty project led by Environmental Sciences with partners in the Department of Educational Studies, Sustainability Office and Human Sciences PACE, supported by a Macquarie University Strategic Learning and Teaching Grant.

For more information contact Wendy Goldstein.

AMSI-SSA specialist lecture: Assessing time-varying causal interactions and treatment effects with applications to mobile health

The Australia Mathematical Sciences Institute (AMSI) and the Statistical Society of Australia (SSA) are hosting a specialist lecture by Professor Susan Murphy from Harvard University on campus on **Friday 24 August**.

Mobile devices along with wearable sensors facilitate our ability to deliver supportive treatments anytime and anywhere. Indeed mobile interventions are being developed and employed across a variety of health fields, including to support HIV medication adherence, encourage physical activity and healthier eating as well as to support recovery in addictions.

A critical question in the optimisation of mobile health interventions is: "When and in which contexts, is it most useful to deliver treatments to the user?" This question concerns time-varying dynamic moderation by the context (location, stress, time of day, mood, ambient noise, etc.) of the effectiveness of the treatments on user behaviour. In this talk we discuss the micro-randomised trial design and associated data analyses for use in assessing moderation. We illustrate this approach with the micro-randomised trial of HeartSteps, a physical activity mobile intervention. Find out more.

Connect with us

If you have comments, questions or research news you think might be of interest to the rest of Faculty, I'd love to hear from you. Drop me a line at fse.execdean@mq.edu.au.

Connect with your Faculty online:

- Website: science.mq.edu.au
- Faculty on Twitter: @MQSciEng
- Barbara on Twitter: @BarbaraMesserle

Got a story?

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