MACQUARIE University

FACULTY OF SCIENCE AND ENGINEERING

April 2018

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From the Dean

NEWSLETTER | APRIL ISSUE

Dear Suzannah

Collaboration is the cornerstone of scientific research, and I'm always thrilled when I see our researchers taking up leadership roles on projects that will have national and global impact – as they have in the past week.

Last week the Assistant Minister for Science, Jobs and Innovation, Senator Zed Seselja announced the new $200 million Digital Health CRC, which aims to transform health delivery in this country. I'm very proud our Faculty is a part of the centre through our Department of Computing. Computing's Michael Sheng will co-lead one of the CRC's four research programs.

Environmental Science's Paul Beggs is one of the co-leaders of the multidisciplinary team behind the inaugural Australian edition of *The Lancet Countdown* report on health and climate change. On Monday it was announced that Australia will be joining this global initiative to track progress on health and climate change.

And on Wednesday the 'DNA' of more than 340,000 stars in the Milky Way was revealed by an Australian-led group of astronomers, including our own Daniel Zucker from the Department of Physics and Astronomy.

Sourabh Khandelwal, from our School of Engineering, has developed a model for a GaN (gallium nitride) transistor that has been adopted as an international standard. GaN transistors are emerging as a go-to technology to replace silicon transistors in future applications like 5G communications and sensing electronics in autonomous cars. Sourabh is already working closely with industry but expects that the acceptance of his model will lead to many more research collaborations. Congratulations Sourabh.

I've also been pleased to see many research stories from our Faculty being featured on Macquarie's new news website The Lighthouse. I encourage you to explore the site if you haven't already. You'll find stories about shark-repellent surfboards, diamond

laser beams and how baker's yeast made in a lab is set to change the world, to mention just a few of my favourites.

Read on for more news in this month's newsletter including: using nanoparticles to better target tumours, how innovative clinical research by our Chiropractic department is being recognised overseas, and what took Statistics' Gillian Heller to a health centre in Fiji.

I also want to tell you about the three big outreach events we are working on as a Faculty in 2018.

And on a more sombre note, the recent fire in one of our Molecular Sciences' labs is a timely reminder of the responsibility we all need to take in workplace health and safely. Thankfully no one was hurt but we will be undertaking a follow-up of the incident to understand how it occurred.

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 me at fse.execdean@mq.edu.au and we'll share the news.

Regards,

Barbara

In this bulletin

FSE part of $200 million digital health R&D initiative

The Faculty is very proud to be part of the new Digital Health CRC (Cooperative Research Centre) which was announced by Assistant Minister for Science, Jobs and Innovation, Senator Zed Seselja last week.

The CRC will invest over $200 million to develop and test digital health solutions that work for real patients in real hospitals and health services, while equipping Australians to better manage their own health and wellness.

The main participants in the CRC from Macquarie will be our Department of Computing, and the Centre for the Health Economy led by Henry Cutler.

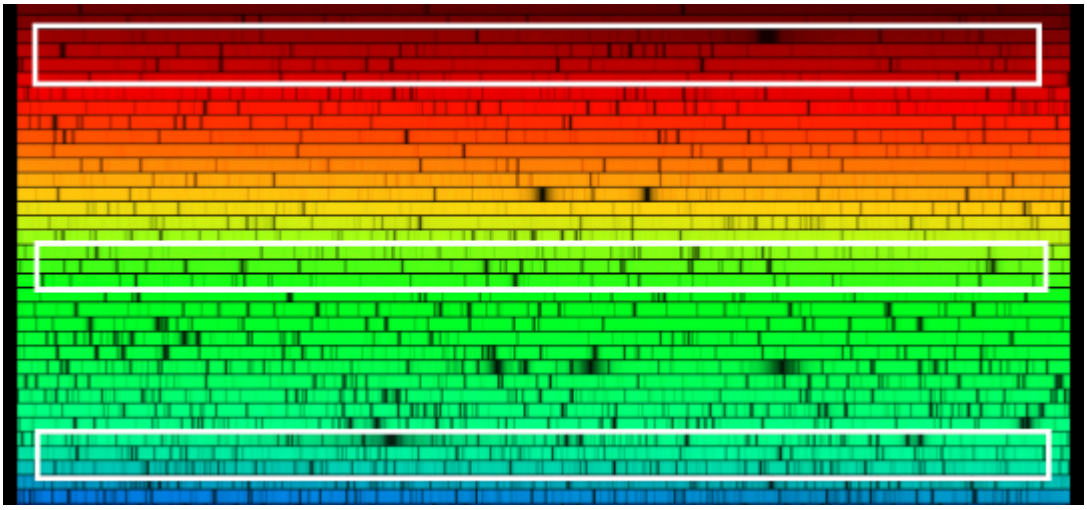
Computing's Head of Department Michael Sheng will co-lead one of the four research programs in the CRC.

"Our involvement in this CRC is a testament to the strong research leadership and capacity of Macquarie University in computing, in particular in big data analytics, machine learning, cyber security, and the Internet of Things," says Michael.

"This CRC provides an excellent opportunity for Macquarie researchers to participate in industry-led research to address national challenges."

Find out more

'DNA' of 340,000 stars interrogated in search for Sun's lost siblings



The ‘DNA’ of more than 340,000 stars in the Milky Way has been revealed by an Australian-led group of astronomers, including scientists from our Faculty.

This data should help the team find the siblings of our Sun, now scattered across the sky.

The research is part of an ambitious Galactic Archaeology survey, called GALAH, launched in late 2013 as part of a quest to uncover the formulation and evolution of galaxies.

The collected ‘DNA’ traces the ancestry of stars, showing astronomers how the Universe went from having only hydrogen and helium—just after the Big Bang—to being filled today with all the elements we have here on Earth that are necessary for life.

Dr Sarah Martell from UNSW Sydney, explains that the Sun, like all stars, was born in a group or cluster of thousands of stars.

“Every star in that cluster will have the same chemical composition, or DNA—these clusters are quickly pulled apart by our Milky Way galaxy and are now scattered across the sky,” she says.

“The GALAH team’s aim is to make DNA matches between stars to find their long-lost sisters and brothers.”

For each star, this DNA is the amount they contain of each of nearly two dozen chemical elements such as oxygen, aluminium, and iron.

The team worked this out by first collecting the light from a star with the telescope and then passed it through an instrument called a spectrograph, which splits the light into detailed rainbows, or spectra.

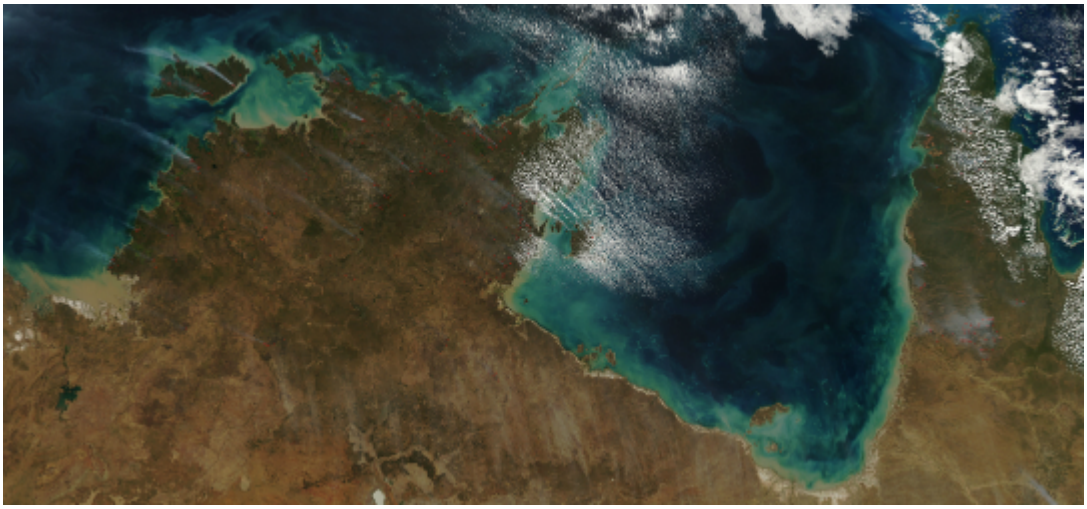
The Department of Physics and Astronomy’s Daniel Zucker says astronomers measured the locations and sizes of dark lines in the spectra to work out the amount of each element in a star.

“Each chemical element leaves a unique pattern of dark bands at specific wavelengths in these spectra, like fingerprints,” he says.

Find out more

Photo by N.A. Sharp, NOAO/NSO/Kitt Peak FTS/AURA/NSF.

What are the health impacts of climate change in Australia?



Australia will join a global initiative to track progress on health and climate change, and one of our scientists is closely involved.

Environmental Sciences’ Paul Beggs is one of the co-leaders of the multidisciplinary team behind the inaugural Australian edition of *The Lancet Countdown* report on health and climate change.

The report, which was first published by medical journal *The Lancet* in October 2017 and will be updated annually through to 2030, tracks progress on health and climate change across 40 different indicators.

Writing in *The Medical Journal of Australia* earlier this week, Paul and co-author Ying Zhang from the University of Sydney said: “As we end another Australian summer, the increasing threat of heatwaves and tropical cyclones and the direct and indirect deaths and diseases that accompany these should be at the forefront of our minds.”

“The project recognises the importance of the climate change challenge in Australia, including its relevance to human health, and also the unique breadth and depth of the Australian expertise in climate change and human health.

“We hope to raise awareness of health issues related to climate change among Australian medical professionals, who play a key role in reducing their risks.

“The Australian countdown is also envisioned as a timely endeavour that will accelerate the Australian government response to climate change and its recognition

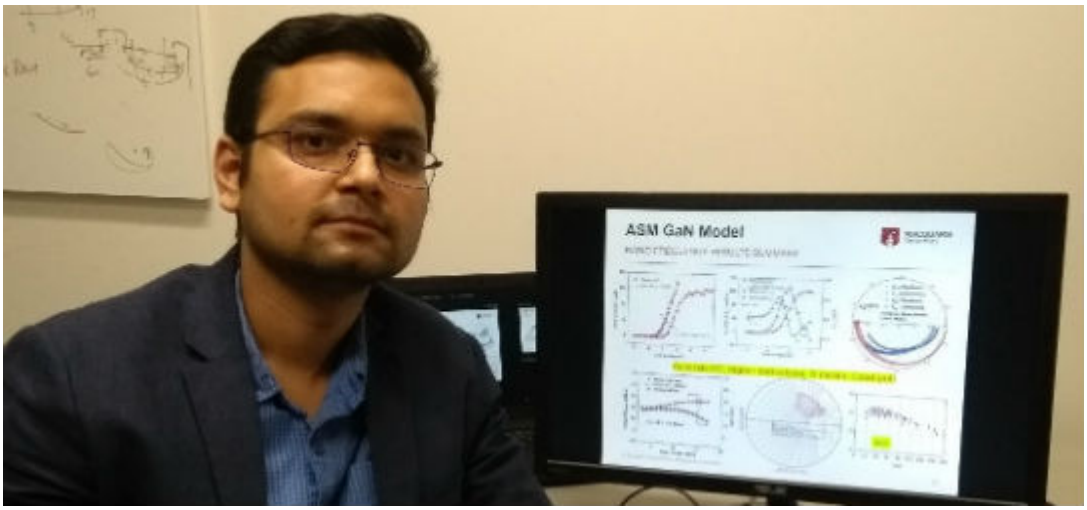
of the health benefits of urgent climate action."

The inaugural Australian report is planned for release later this year.

Find out more

Photo by NASA/Goddard, Lynn Jenner

Transistor model sets the standard



Engineering's Sourabh Khandelwal has developed a model for a GaN (gallium nitride) transistor that has been adopted as an international standard.

Silicon transistors are a critical part of modern electronics. There's a few million of them in your smartphone alone, but owing to their fundamental material limitations they're extremely inefficient for emerging applications.

GaN transistors are emerging as a go-to technology for use in future applications like 5G communications, sensing electronics in autonomous cars, and compact converters for renewable energy. They're more efficient than silicon, meaning they'll use less power and can also be made smaller than silicon transistors.

But it's been difficult to model the complex behaviour of GaN transistors until now. Sourabh's model has been developed from fundamental physics and will allow design engineers to carefully tune the behaviour of their circuits before they start fabrication.

"It is very exciting, as well as deeply satisfying, for my model to be accepted as an international standard," says Sourabh, "as now the whole world of electronics engineers will be designing their products using it."

An international industry consortium is already funding Sourabh's research, and he expects that the acceptance of his model will lead to many more research collaborations with industry, research centres and universities.

Using nanoparticles to better target cancer tumours

Congratulations to Molecular Sciences' Andrew Care who has been awarded a 2018 Early Career Fellowship from the Cancer Institute NSW.

Andrew's fellowship will fund research looking at how biological nanoparticles can be used to better deliver anti-cancer drugs to destroy tumours.

Andrew and his team are re-engineering protein-based nanoparticles that are normally found in microorganisms, like bacteria. These re-engineered nanoparticles will be capable of carrying anti-cancer drugs to tumours inside the body.

Once there, the nanoparticles can be activated by light to break apart, allowing the drugs to be released at their desired location, where they are needed most.

This approach is unlike many conventional cancer therapies, where drugs become distributed throughout the whole body making them less effective at the tumour site, and causing adverse side effects in healthy cells and tissues.

In another win for the team, PhD Candidate Dennis Diaz was recently awarded a Research Scholarship Award from translational cancer research centre, Sydney Vital. She is working under the supervision of Andrew Care and Anwar Sunna.

Chiro and pulmonary disease

Exercise can improve the quality of life for people with mild chronic obstructive pulmonary disease (COPD), according to research from Chiropractic's Roger Engel and Subramanyam Vemulpad, Petra Graham from Statistics, and Peter Gonski from Sutherland Hospital.

Their research won the National Board of Chiropractic Examiners' award for 'Best Scientific Paper' at the Association of Chiropractic Colleges Research Agenda Conference (ACC-RAC) last month.

The team are the chief investigators on a study looking at the medium-term effect of spinal manipulative therapy for COPD.

Results from the study showed that for people between the ages of 50 and 65 with mild COPD, undertaking a 16-week exercise program improved the amount of exercise they could do in a fixed amount of time—known as their exercise capacity—as well as their quality of life, anxiety and depression.

However, combining spinal manipulative therapy and exercise did not produce any additional improvements.

"Exercise capacity is an indicator of prognosis in COPD," says Roger.

"The importance of these results is that they provide evidence to support the earlier use of exercise for people with COPD when the potential to slow progression of the disease is greater."

The ACC-RAC is the largest annual chiropractic research conference in the world, attracting researchers from the US, Canada, Europe, South-East Asia, Australia and New Zealand.

The team's award came with $US1,000 prize money and publication of their paper in the *Journal of Manipulative and Physiological Therapeutics*.

"Our award raised the profile of Macquarie University as an institution involved in innovative clinical research," says Roger. "It also resulted in discussions with US researchers regarding the possibility of future collaborations."

Outreach takes Statistics to Fiji

Fijian community leaders are being empowered to take ownership of health and social issues within their communities, with the help of a Macquarie statistician.

Gillian Heller recently visited the Viseisei Sai Health Centre in Fiji, where she conducted a data analysis workshop for staff involved in the pilot project 'Collective Community Ownership of Health and Social Issues'.

The team of health educators, nurses and other health professionals behind the project, visit rural villages where they conduct health education sessions and facilitate sustainable interventions which target lifestyle risk factors and promote improved public health.

As part of this work, survey and clinical data on the participants is collected.

In her workshop Gillian guided the team through issues of questionnaire design, data cleaning and integrity, and worked through the analysis of the data with them.

"The results of the data analysis told us a lot about public health and social issues in rural Fiji," says Gillian. "Once they've been shared more widely, it's hoped they will inform public policy in Fiji and the broader Pacific."

This was Gillian's second trip to Fiji to work with the centre, following an invitation from her hosts Dr Swaran Naidu and Professor Rajat Gyaneshwar.

"It's tremendously satisfying playing a role in the improvement of community health in a developing country," she says. "Working with the local people, who are so dedicated to their mission, was a great privilege."

Find out more

Astronomy, NASA and National Science Week

Engaging with the public through outreach activities is a crucial part of demonstrating our value, and the value of our research, to the broader community.

There are three big outreach events we are working on in 2018 for FSE.

The first is the **Astronomy Open Night** which will take place on Saturday 19 May, and is presented by the Macquarie University Association for Astronomy and the Department of Physics and Astronomy.

This annual event has been run for over 25 years which is a huge achievement. Up to 30 telescopes will be aimed at the glittering night sky and Sarah Brough from UNSW Sydney will be the keynote speaker. Sarah's talk 'Stellar Metropoles' will cover how galaxies beyond the Milky Way formed and changed over cosmic time and other unsolved puzzles in cosmic history.

From 23 to 27 July Macquarie is partnering with NASA, the Canberra Deep Space Communication Complex, and One Giant Leap for the pilot of **STEM and Your Future**. The five-day event of teacher training days and student workshops is the first of its kind to run in NSW and will include presentations from five scientists from NASA's Jet Propulsion Laboratory. Teachers will have the opportunity to become trained to use NASA's Goldstone Apply Valley Radio Telescope. And both teachers and students will have exclusive access to the Deep Space Network without leaving the classroom. Academic staff from the School of Engineering, Department of Physics and Astronomy and Department of Mathematics and Statistics will also be involved in the event.

This year **National Science Week** will be from 11-19 August, and I'm excited by all the ways our Faculty is getting involved in Australia's biggest celebration of science. Last year there were over 2,100 events nationwide, and this year promises to be even bigger.

Once again we're one of the educational partners for the Sydney Science Festival. Event highlights include Molecular Sciences running the Indigenous Science Experience @ Redfern, Physics and Astronomy travelling to four regional NSW towns in four days for Pocket Astronomy in Pocket-sized Towns, Biology's Wild Science Race

and Night of Illusions, and Environmental Sciences speaking at the Northern Suburbs Science Hub's event and Science on the Road.

For more information about any of the Faculty's outreach activities contact our Outreach Project Officer Rachelle Carritt.

Molecular Sciences fire

Thursday 5 April was a dramatic day for Molecular Sciences.

An unfortunate combination of sodium metal, water, organic solvent and the plastic surrounds of a fume hood resulted in an incident with more than 10 emergency services vehicles called.

Thankfully no-one was hurt and the damage is largely to floors and flooring and the electrics, but very small differences in how people reacted, or how water flows in the Department could have left us in a very different situation.

This is a reminder to all of us that we need to respect how we handle dangerous chemicals, be constantly alert for the 'unexpected', and follow ongoing lab WHS processes.

It is also a significant reminder that we need to work together to look after safety in our laboratories, and respect the need for each of us to take responsibility for our colleague's and our own WHS.

We will be undertaking a follow-up to understand how this occurred and an audit of our lab safety.

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 @BarbaraMesserle and @MQSciEng.

RT @Macquarie_Uni: Since #Trump took office 15 months ago, his administration has shown a clear disdain for expertise and facts. @ElizMadin an expat US scientist, explains why she is returning to America to #StandUpforScience via @ConversationUS Read the article

RT @MQBiology: Wild Australian rice could be the key to feeding 11 billion people? Prof Brian Atwell believes "We can make huge steps forward." Read the article

"A new view of an old cave - that still has some secrets to share!" says co-author @EnvScMQ's @lumilicious. Brumm et al. discover an undocumented cultural horizon in Leang Burung II cave in Sulawesi showing human occupation alongside megafauna Find out more

RT @MQScoop: Our own @DrMichellePower featured on 2SER show A Question of Balance, talking about our #citizenscience project. Read and listen to her interview @MQBiology @MQSciEng

Congratulations @VanessaPirotta on more success sharing your research with the public. QT @auBritish: Congratulations to tonight's #FameLabAus winner Richard Charlesworth @DrCarnivorous runner up @KhandisBlake and audience choice winner @VanessaPirotta for their exceptional expression of STEM stories and research in the FameLab semi-final for NSW

RT @MQMolSci: Are you an undergrad and interested in synthetic biology? Do you want to solve global challenges as a team? Apply now to join the @Macquarie_Uni 2018 iGEM team and help us bring home the Gold! Course credit through PACE-FOSC300 possible. Apply by 14/5/18

"I think of every species as a unique heritage item & just as we would be devastated if we lost our Opera House... we could rebuild the Opera House but at the moment we can't rebuild a species" @MQBiology's Lesley Hughes talks extinction with @NightlifeABC Listen to her interview

Nathan is partnering with @smartmarinesys @tarongazoo @UWAnews @nswdpi to develop and commercialise his smart approaches to shark safety: QT @MQSciEng: "100% successful in preventing great white sharks from attacking" says @MQBiology Nathan Hart in today's @Australian. He's using surfboards with specific patterns of LEDs that change the appearance of the silhouette to sharks. Read the article

RT @Macquarie_Uni: Is Facebook listening to your conversations through the microphone on your computer or mobile phone? Are all those conspiracy theories right? Read the article on The Lighthouse #LighthouseNewsflash

In a nutshell, my job is to "identify & develop deep relationships between @MQSciEng & external partners". Spend 60 seconds with our Engagement Manager Louise McDonald

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Faculty bulletin

New staff | Current vacancies | Staff Anniversary Awards | Flu vaccinations | Head shots | University bioQuest progress report

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 **John Creech** who has joined Earth and Planetary Sciences as a research fellow from the Institut de Physique du Globe de Paris.

Remi Rouquette is a senior analytical technician with Molecular Sciences and joins Macquarie from the University of Strasbourg.

Josh Griffiths is a senior scientific officer (terrestrial fieldwork) with Biological Sciences and joins us from UNSW.

Amir Safari is a technical support officer -electrical with Engineering and was previously with the National Iranian Tanker Company.

And **Peter Anderson** is a research fellow with Computing, joining us from the Australian National University.

Current vacancies

We're looking for a lecturer or senior lecturer with a strong research track record in the area of contaminant science to join the Department of Environmental Sciences.

Molecular Sciences is seeking a research officer with molecular microbiology experience to contribute to the project on 'Improving the efficacy of pseudomonas biocontrol bacteria'.

Statistics is looking for an associate lecturer or lecturer for a part-time, teaching-only role.

Computing is seeking a lecturer in computer games to contribute to research and teaching in the broad areas of video games and interactivity.

Staff Anniversary Awards

Congratulations to all our staff recognised for 25+ years of service at the recent Staff Anniversary Awards.

They were Physics and Astronomy's Judith Dawes; Statistics' Gillian Heller; Computing's Steve Cassidy, Mehmet Orgun and Jackie Walsh; Engineering's Karu Eselle; Molecular Sciences' Helena Nevalainen; and Richard Miller.

Free flu vaccinations

All staff are entitled to a free flu vaccination during the period 30 April to 1 June.

Protect yourself, your family and your colleagues from the highly contagious influenza virus by taking part in Macquarie's 2018 flu shot program.

Book your flu shot.

Head shots

A photographer will be available to take head shots for all FSE staff on Monday 23 April from 10:30am–2:30pm in the E6A242 Conference room.

Please register for your preferred time online. The shoot will only take each person approximately two to three minutes.

University bioQuest – less than two weeks to go

Macquarie University is in third place!

But with less than two weeks to go we need more participants. So sign up and start looking for interesting animals and plants before the end of the month.

Macquarie University currently has 26 members. Our team includes top spotters and top identifiers.

Last week, team member Jenny Donald gave us some tips on which birds are currently visiting campus and which critters are scoring well. On Saturday, the Biological and Environmental Science student group (BAES) went on a spotting blitz.

Need more incentives? There's $250,000 worth of Amazon Gift Vouchers to be won!

Join the Quest today! Find out more about how to get involved.

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?

Macquarie University NSW 2109 Australia
T: +61 2 9850 7111 / F: +61 2 9850 7433