MACQUARIE University

FACULTY OF SCIENCE AND ENGINEERING

28 May 2019

Suggest a story

From the Dean

NEWSLETTER

It was great to celebrate the success of our graduates during last month's graduation ceremonies, and wish them well as they embark on the next stages of their careers. Hopefully some of them will be interested in pursuing research, particularly as we will be part of two exciting new Cooperative Research Centres announced last month.

Macquarie University engineers will develop new technologies for ocean infrastructure as part of the Blue Economy CRC, the largest CRC in the history of the scheme. And we're also a partner in the SmartSat CRC, where we'll further develop technologies to enable satellites to communicate with each other and with users, faster and more efficiently.

FIRST Australia is holding two events in July—the *FIRST* LEGO League Asia Pacific Open Championship (4-7 July) and the Duel Down Under (26-28 July)—and we need your help! We're looking for volunteers to serve as referees, judges and more at the events. As an added incentive, Macquarie University staff can now use their volunteer leave entitlements to assist at these events.

In other news, the University has submitted its application for an Athena SWAN Bronze Institution Award, demonstrating our commitment to improving gender equity. Macquarie is part of the SAGE (Science in Australia Gender Equity) Athena SWAN Pilot, along with 45 other Australian universities and research institutes, and this is an exciting milestone in our journey to create a more equitable and inclusive institution for all our staff. I am strongly committed to achieving gender equity across the Faculty, for

all staff and students, and I am thrilled that we are starting to make some real impact on this.

In research news from the Faculty we look at the impact plastic pollution is having on the bacteria that helps us breathe, whether behaviour can explain why some animal species become invasive, and a new study that has found children in Port Pirie are being exposed to the highest levels of toxic airborne lead and sulphur dioxide in Australia. And we celebrate accolades from across the Faculty in Congratulations corner.

Read on for information about the nine new staff who have joined the Faculty in the last month, and the three vacancies we're currently advertising.

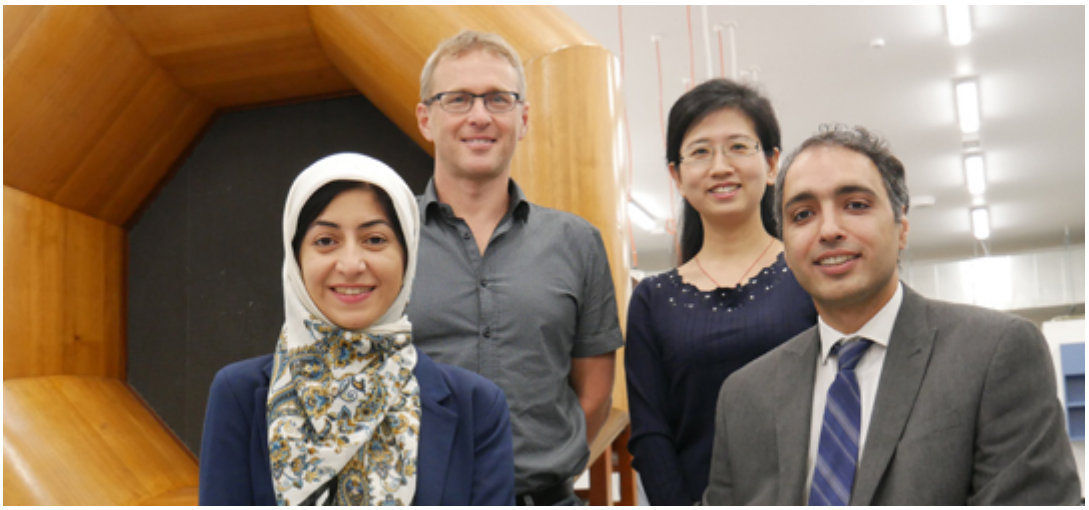
If you want to know more about what's happening across the Faculty, follow our Faculty Twitter account @MQSciEng and Barbara's personal account @BarbaraMesserle. If you've got news to share, please tweet about it and include our Faculty handle so we can see it and retweet. If you're not on Twitter, then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

Regards,

Barbara

In this bulletin

Building farms and towers at sea to feed and power the world



Macquarie University engineers will develop new technologies for ocean infrastructure as part of the Blue Economy Cooperative Research Centre announced last month.

The Blue Economy CRC will drive an evolution in marine-based industries, unlocking enormous economic, environmental and technological benefits in aquaculture and renewable energy in Australia's maritime zone.

"Australia has the third largest maritime zone in the world," says Darren Bagnall, Dean of Engineering. "It is around 10 million square kilometres. That's larger than Australia's land mass. Macquarie University engineers are already working to improve the safety and reliability of oil and gas platforms and of Australian Navy ships. We're excited about the opportunity to build on this expertise to create new kinds of infrastructure that will operate safely and efficiently far out to sea," he says.

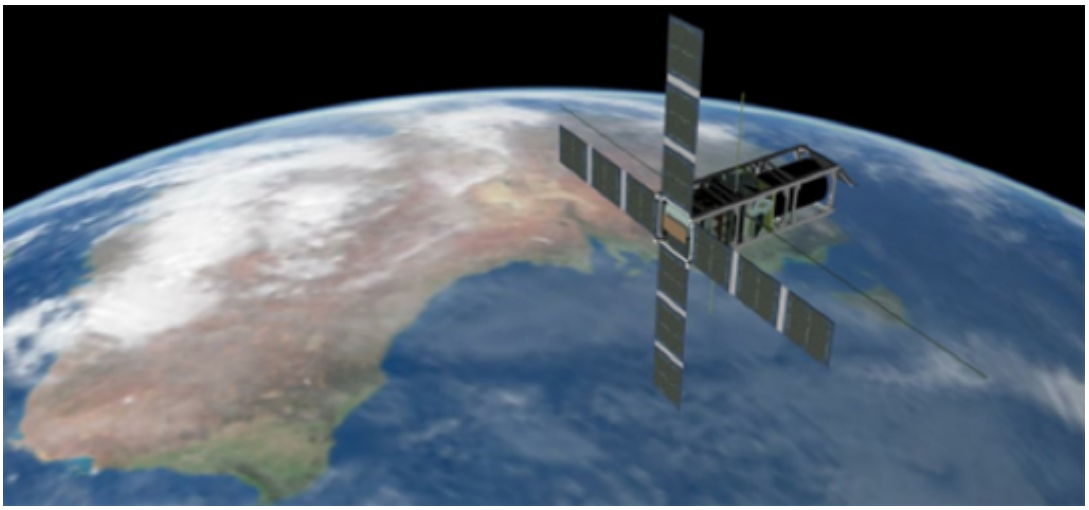
"We can only move seafood and energy production offshore if we can ensure safe operations under extreme ocean environments," says Engineering's Rouzbeh Abbassi, leader of Macquarie's contribution to the CRC. "We are providing expertise in assessing and evaluating safety, reliability and economic viability of different offshore structures and in different ocean energy resource development," he says.

The $329 million research project is a 10-year collaboration between six Australian research agencies, 25 industry and government partners, and a dozen international partners underpinned by a $70 million cash investment from the Federal Government. It's the largest CRC in the history of the scheme.

The CRC is expected to generate more than $4 billion for the national economy.

Find out more

Macquarie University to link Australia's future smart satellites



Macquarie is a partner in the $245 million SmartSat CRC announced in Adelaide last month.

Eighty-four research and industry partners are contributing $190 million investment in cash and in kind to the new Cooperative Research Centre for Smart Satellite Technologies and Analytics, and the Australian government is contributing a further $55 million. The CRC is led by the University of South Australia.

"A new generation of low-cost smart satellite technology has the potential to enhance agriculture, mining, communication and national security," says Engineering's Sam Reisenfeld, who leads Macquarie's contribution to the CRC.

"Macquarie University is excited by the potential of the new CRC," says Darren Bagnall, Dean of the School of Engineering. "We were pioneers in creating fast, reliable Wi-Fi chips, and today we continue to lead in wireless and satellite communication technologies."

"Through the CRC we will further develop our technologies to enable satellites to communicate with each other and with users faster and more efficiently," says Sam. "Our contributions to the CRC will include artificial intelligence-based algorithms for satellites and Earth stations, technologies to integrate satellites with 5G phone networks, and ways to utilise satellite technology in the Internet of Things."

The new CRC will be headquartered in South Australia but will establish state nodes to ensure that the whole of the nation is involved in the development of smart satellite technologies which will meet Australia's needs to secure its defence, telecommunications and monitoring technologies into the future.

Read more

Plastic pollution harms the bacteria that help us breathe

Ten per cent of the oxygen we breathe comes from just one kind of bacteria in the ocean. Now laboratory tests have shown that these bacteria are susceptible to plastic pollution, according to a study published in *Communications Biology* earlier this month.

“We found that exposure to chemicals leaching from plastic pollution interfered with the growth, photosynthesis and oxygen production of *Prochlorococcus*, the ocean’s most abundant photosynthetic bacteria,” says lead author Molecular Sciences’ Sasha Tetu.

“Now we’d like to explore if plastic pollution is having the same impact on these microbes in the ocean.”

Plastic pollution has been estimated to cause more than US$13 billion in economic damage to marine ecosystems each year, and the problem is only getting worse with marine plastic pollution estimated to outweigh fish by 2050.

“This pollution can leach a variety of chemical additives into marine environments, but unlike the threats posed by animals ingesting or getting entangled in plastic debris the threat these leachates pose to marine life has received relatively little attention,” says Molecular Sciences’ Lisa Moore, a co-author on the paper.

In the first study of its kind, the researchers looked at the effects these chemicals have on the smallest life in our oceans, photosynthetic marine bacteria.

“We looked at a group of tiny, green bacteria called *Prochlorococcus* which is the most abundant photosynthetic organism on Earth, with a global population of around three octillion (~10^{27}) individuals,” says Sasha.

“These tiny microorganisms are critical to the marine food web, contribute to carbon cycling and are thought to be responsible for up to 10 per cent of the total global oxygen production,” says Lisa, explaining the fundamental importance of these microbes to ocean health.

“So one in every ten breaths of oxygen you breathe in is thanks to these little guys, yet almost nothing is known about how marine bacteria, such as *Prochlorococcus* respond to human pollutants.”

In the lab, the team exposed two strains of *Prochlorococcus* found at different depths in the ocean to chemicals leached from two common plastic products—grey plastic grocery bags (made from high-density polyethylene) and PVC matting.

They found that exposure to these chemicals impaired the growth and function of these microbes—including the amount of oxygen they produce—as well as altering the expression of a large number of their genes.

Find out more

Photo by Kevin Krejci.

Can behaviour explain why some animal species become invasive?

A new study has found that adaptability is the key to invasive species succeeding in non-native environments.

The study published in *Animal Behaviour* compared the behaviour of two closely related lizards to understand why only one species has become established in several locations throughout the world.

The Italian Wall Lizard and Green Iberian Wall Lizard may look like close relatives, but key differences in their behaviour explained why the Italian Wall Lizard is the successful invasive species of the two.

Researchers from Macquarie University found that the invasive lizard was more exploratory, bold, and comfortable in new environments—all factors that are likely to contribute to the lizard's success as an invasive species. The invasive Italian Wall Lizard was also more flexible in its behaviour, pointing to adaptability as an essential behavioural trait for successfully invading different environments.

Biology's Isabel Damas-Moreira, the lead author of the study, says invasive species have enormous ecological and economic costs and the world's growing population will create more opportunities for these species to spread.

"Invasive species like the Italian Wall Lizard use human transportation to hitchhike and invade new locations," she says.

Find out more

Lead smelter still exposing Port Pirie children to unacceptable levels of pollution

Children in Port Pirie are being exposed to the highest levels of toxic airborne lead and sulphur dioxide in Australia, causing respiratory problems and risks to cognitive development.

According to a new study, these serious risks to human health have accelerated in the last few years despite decades of warnings about the health impacts of pollution from the nearby smelter.

The study found that almost half (47 per cent) of children under five years old have dangerous levels of lead in their blood, with levels increasing in tandem with smelter emissions.

In addition, presentations to the local emergency department for respiratory issues are occurring at more than double the rate of other areas of regional South Australia, with children being disproportionately affected.

Lead pollution across the city from the smelter at Port Pirie continues to remain close to the national annual guideline of 0.5 µg/m^3, with daily peaks and annual concentrations in some parts of the city exceeding this level.

This guideline in itself is however inadequate to protect Port Pirie's children. The study led by experts from the Department of Environmental Sciences and published in *Environmental International* found that the levels of lead in air need to be 80 per cent lower than the current national guideline to ensure that children's blood lead levels stay below the national intervention threshold of 5 µg/dL.

Find out more

Photo by Denis Bin/Flickr.

Volunteers needed for *FIRST*'s July events

FIRST Australia is looking for volunteers to help out at their July events—the *FIRST* LEGO League Asia Pacific Open Championship (4-7 July) and the Duel Down Under (26-28 July).

The Asia Pacific Open Championship is an off-season event with some of the top ranking *FIRST* LEGO League teams from around the world competing at Macquarie University.

Teams will be travelling from the Philippines, Russia, South Korea, Turkey, Taiwan, the USA, Vietnam, Nigeria, Pakistan, New Zealand, Mexico, Malaysia, Japan, Indonesia, India, Germany, China, Brazil, Estonia and around Australia to take part in the event.

Volunteers are needed to serve as referees, judges, scorekeepers, queuers, and more. This year's *FIRST* LEGO League challenge theme is INTO ORBIT.

The Duel Down Under is an annual off-season event for Australian *FIRST* Robotics Competition teams. These are the biggest robots in the *FIRST* family of programs.

Roles are available for robot inspectors, referees, control systems advisors, queuers, judges and more. The game theme for 2019 is Destination: Deep Space.

Since bringing *FIRST* Robotics to Australia in 2006 Macquarie University, with the support of our partners, has given thousands of students invaluable new skills in science, technology, engineering and maths to better prepare them for the jobs of the future.

And we'd love you to help us and share your love of STEM at one of our upcoming events.

As an added incentive, Macquarie University staff can now use their volunteer leave entitlements to assist at these events.

Jack Aakhus (centre in picture above) has volunteered for *FIRST* Australia for many years. He is the Head Referee for *FIRST* LEGO League in Australia and emcees the *FIRST* Robotics Competition Regionals.

Jack says he loves volunteering at *FIRST* events because it allows him to inspire young people to believe more in themselves.

"Young people have the potential to achieve great things but so many lack the confidence to do so," he says.

"That's where *FIRST* volunteers make a difference! By challenging and encouraging these young people and recognising their efforts we are impacting their lives in positive ways—and that's priceless!"

If you're interested in volunteering at either of July's events please contact *FIRST* Australia's Lead Volunteer Coordinator Susanna Westling at volunteers@ausfirst.org.

Making progress in gender equity

Macquarie University has submitted its application for an Athena SWAN Bronze Institution Award, demonstrating our commitment to improving gender equity across the university.

Macquarie is part of the SAGE (Science in Australia Gender Equity) Athena SWAN Pilot, along with 45 other Australian universities and research institutes.

Originally developed in the UK in 2005, the Athena SWAN charter requires institutions to conduct an in-depth self-assessment of their current situation, looking at their structures, systems and culture to identify gaps in and barriers to gender equity.

“We’ve been working on this project since we were accepted into the pilot in June 2016, under the lead of our gender equity self-assessment team (GESAT),” says Harriet Jones, Diversity and Inclusion Consultant and Macquarie’s SAGE Project Officer.

“This has involved analysing quantitative data, such as our staff profile, recruitment, promotion, parental leave and pay data from a gender perspective, as well as undertaking a qualitative analysis to understand the experiences of staff at Macquarie.”

Based on this analysis, the GESAT (pictured above) have developed a four-year action plan to progress gender equity.

“At Macquarie, we’re taking a different approach,” explains Harriet. “We know that to make real progress, we need to transform the traditional approach to diversity and inclusion.”

“Our approach is to ‘fix the system’—meaning we're focusing our attention on the policies, systems, processes and cultures that create and maintain inequality. This means changing the way we do things.”

While SAGE covers the STEMM disciplines—so people at Macquarie working for the Faculties of Science and Engineering, Human Sciences, and Medicine and Health Sciences—the GESAT is considering gender equity across the university.

Find out more about how we’re fixing the system at Macquarie

Expert in keeping computing systems safe joins Faculty as an honorary professor

Oxford’s Marta Kwiatkowska has been appointed as a honorary professor with the Department of Computing for the next five years.

“Professor Kwiatkowska’s research is primarily in the theory of computer science, but its practical implications have influenced a broad range of scientific disciplines including distributed computing, wireless networks, security, robotics, healthcare, systems biology, DNA computing and nanotechnology,” explains Computing’s Annabelle McIver.

Recently, Marta visited Macquarie to deliver her 2018 Milner Award Lecture, When to trust a self-driving car.

“Having Professor Kwiatkowska as Honorary Professor with the Department of Computing reinforces the profound role of computer science across many scientific and engineering fields, and contributes to our goal of lifting visibility and academic excellence,” says Computing’s Head of Department Michael Sheng.

“It also demonstrates the Faculty’s strong support of outstanding women in STEM.”

Macquarie third best spotter at University BioQuest

Macquarie University was the third best team for sightings in this year's University BioQuest.

University BioQuest is an international competition between universities to photograph, upload and identify photos of animals and plants and fungi on and around their campuses, held during the month of April.

In Australia, the data collected contributes to scientific knowledge on species distribution through the Atlas of Living Australia.

This is the second year we have participated, and we've improved on our fourth place last year.

We also earn points for correct identification of images (ours or anyone else's).

At the time of writing, we were coming second for correct identifications.

This year we had 65 team members. Special mention needs to be made again of Biology's Jenny Donald.

Currently Jenny is in third place for both individual sightings and individual identifications. The current placing of the Macquarie team is largely due to Jenny's efforts.

Other top scorers in the Macquarie team include Chris Reid, Belinda Fabian, teatales, Josie Kirkwood, Oceantree, Levi, Ben, George Binns and Kawsar.

Thanks to everyone who contributed. You're all awesome!

Composite photo above of Aeolochroma hypochromaria moth (Angela Moncrieff), European stonechat (Jenny Donald) and broad-tailed gecko (Angela Moncrieff).

Congratulations corner

Congratulations to Engineering's Mohsen Asadnia who's leading a project to develop a compact gas-sensing device to spot explosives, using chemistry and artificial intelligence.

In partnership with collaborators in India, Indonesia and the Netherlands, Mohsen's project was one of 14 funded in round two of the Regional Collaborations Programme announced last month.

Maria Kovaleva has graduated with a PhD in Electronic Engineering and been awarded the Vice-Chancellor's Commendation—the highest honour at Macquarie University for a PhD student.

"This is believed to be the first ever Vice Chancellor's Commendation in Engineering at Macquarie University, and most likely the first and only Vice Chancellor's Commendation since PhD research in Electronics was started at the university by Professor Skellern over 25 years ago," says Maria's supervisor Karu Esselle.

Congratulations to Biology's Simon Clulow who has been awarded the British Ecological Society's Southwood Prize for his paper exploring how altering environmental salinity could protect amphibians from chytrid disease—a fungus threatening frogs worldwide.

Engineering's Atul Minhas has received an Endeavour Executive Leadership Award. He will visit Kyung Yee University in South Korea, to undertake a joint research project to develop multi-physics theoretical models for their experimental results.

Macquarie researchers are involved in two Linkage projects that were funded last month.

Engineering's Tara Hamilton is part of a project aiming to develop an artificial intelligence that can help both composers and non-musicians make new music.

Environmental Sciences' Katherine Dafforn and Biology's Melanie Bishop are part of a project developing a framework for effective oyster reef restoration.

And congratulations to Engineering's Next-Generation Integrated Photovoltaic Structures and Molecular Sciences' HydGene Renewables. Both teams have been accepted into CSIRO's ON Prime program.

Engineering's team of Noushin Nasiri, Anita Ho-Baillie, Shujuan Huang, Shuying Wu, Graham Town and Supriya Pillai are undertaking a project that aims to integrate thin-film solar cells onto building materials.

Molecular Sciences' team of Kerstin Petroll, Jocelyn Johns, Sam King, Tony Jerkovic, Robert Willows and Anna Grocholsky are working on generating electricity from waste using biohydrogen-producing bacteria.

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.

RT @CAPSTAN_Voyages: Want to know more about the sampling from #RVInvestigator this voyage? Check out @LDAW12 's blog

RT @Macquarie_Uni: Better pictures from #space are on the way thanks to @AAOMacquarie researchers. Read more on today's Lighthouse

Did water come to Earth from space or was it here all along? @thecraigoneill from our Planetary Research Centre helps explain a new study of results from the @haya2e_jaxa asteroid mission

RT @nmktse: Do entrepreneurial skills enhance the employability of graduate engineers?

RT @Macquarie_Uni: Why do #volcanoes erupt? Assoc Prof @heatherkhandley from @MqEPS delves into this puzzling question in the latest episode for the Imagine This #podcast series, co-produced by #abckidslisten and @ConversationEDU. Take a listen

RT @DrEmmaLJohnston: Only 7% of our Federal politicians have a #STEMM degree @MyfWarhurst invited myself, Professor Lesley Hughes & @AndrewZwicker to put the case for why we need more scientists to enter politics. #AUSVote2019 #Auspol Listen here

RT @Macquarie_Uni: 10 questions with… Alison Rodger Prof Rodger is a passionate supporter of #genderequity in #STEM, serving on her department's Women in Chemistry and Biomolecular Sciences leadership group

"Now the race begins: there are many reasons to suspect (& Hawking's works were one of the primary motivations) that what is inside is not a black hole, & many arguments why it can or should be," says @MQPhysAstro's Daniel Terno. QT @TheNewDailyAu: Like any major event in the modern age, the internet embraced the first-ever photo of a black hole in traditional style – with memes

RT @sunnalab: Detecting antibiotic-resistant superbugs with #smartphones. Awesome work by Dr Vinoth Kumar Rajendran from @sunnalab using battery-operated PCR and the smartphone reader.

Researchers led by @MQEngineering's Sicong Tian have come up with a process that allows captured carbon to be converted into a useful feedstock for the global chemistry industry

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Faculty news and notices

New staff | Current vacancies | What is Artificial Intelligence in the Modern Classroom?

Welcome to new Faculty staff

A warm welcome to all the new staff who have joined the Faculty in the last month.

Please join me in welcoming **Sweta Thakorlal** who joins the Faculty as an Administration Assistant from JMT Bookkeeping Services.

Kirsty McPhail is the new Department Manager for Chiropractic, joining us from UTS.

Alba Santin Garcia and **Marc Gali Labarias** have joined the Physics and Astronomy as Postdoctoral Research Fellows, both from UTS.

Fabio Berzaghi is a Postdoctoral Fellow in Biology from Laboratoire des Science du Climat et de l'Environment in France.

Wenhai Luo joins Engineering as an MQ Research Fellow, previously at the University of Wollongong.

Ali Pourmiri is a new Postdoctoral Research Fellow in Computing, from the University of Isfahan in Iran.

And AAO-Macquarie has two new members of staff.

Welcome to **Mark Casali**, the new Director of AAO-Macquarie. Mark was previously at the European Southern Observatory.

And **Ellie O'Brien** joins AAO-Macquarie as a Mechanical Engineer from the ANU.

Current vacancies

We're looking for a suitably qualified Lecturer, Senior Lecturer or Associate Professor to contribute to the development and teaching in the broad area of video games and interactivity.

The Optus Macquarie University Cyber Security Hub is seeking a Postdoctoral Research Fellow to design methods to assess privacy implications of machine learning models and develop alternative algorithms to mitigate these privacy issues for the 'Data Privacy in Artificial Intelligence Platforms' (DPAIP) project.

Molecular Sciences is looking for a suitably qualified Senior Analytical Scientist to work within Australian Proteome Facility.

What is Artificial Intelligence in the Modern Classroom?

This workshop on **Thursday 30 May** explores artificial intelligence (AI) and its inevitable impacts on teachers and their students in the modern classroom. It clarifies and demonstrates how AI—already pervasive in everyday activities—can support teachers of all subjects to improve learning and teaching and gain awareness of AI in school administration. Our panel of expert speakers, including Computing's Deborah

Richards, will discuss and share their insights on this interesting and relevant modern opportunity.

Find out more about this course

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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