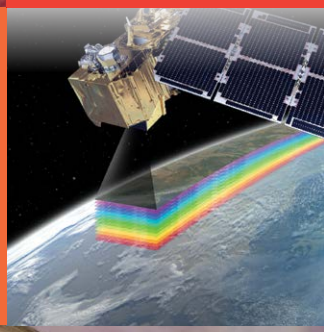
STORIES OF EUROPEAN-AUSTRALIAN RESEARCH

Looking in hearts

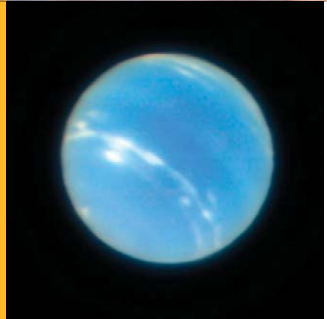
Farmers reap space rewards



Optometrist to the stars

Stem cell powerhouse

Birds in the city



sciencein public

Welcome to Stories of European-Australian Research

Europe and Australia both have much to gain from increased collaboration

Find out about medical advances in fighting cancer, sleep disorders, and in harnessing the power of stem cells.

Learn about the latest telescope technologies that are discovering how planets are born, and looking back in time to the first light in our Universe.

How can we use steel better?
How are cockatoos coping with city life?
And what happened to the mammoths?

These stories and more in our 2022 collection of successful partnerships between European and Australian researchers.

Our thanks to the European Union Delegation in Canberra for making this possible.

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Birds in the city

How cockatoos adapt to an urban environment

A scientist in southern Germany is lifting the lid on Australian birds and how they are learning to open suburban wheelie bins.

Australian researcher Dr Lucy Aplin, at the Max Planck Institute of Animal Behavior, has been awarded an EU grant to delve further into the cognition of sulphur-crested cockatoos—work she began in the suburbs of Sydney.

Cockatoos are extremely gregarious birds that forage in small groups, roost in large ones, and are rarely seen alone.

Dr Aplin has previously studied how cockatoos have learned to open the lids of suburban wheelie bins to forage for food.

Most birds opening bins are males, which tend to be larger than females. The birds that mastered the trick also tended to be dominant in social hierarchies.

"This suggests that if you're more socially connected, you have more opportunities to observe and acquire new behaviour—and also to spread it," Dr Aplin said.

This also means survival: cockatoos are thriving in suburbs where other bird populations are declining.

Cockatoos are thriving in the suburbs

Dr Aplin's goal is to understand the birds' behaviour and social structure using a combination of citizen science and direct observation.

"I study social learning, social networks and culture, mostly in wild populations of birds," she says. "Broadly, I am interested in the interactions between cognition, social dynamics and transmission of behaviour."

Her unique research deepens science's understanding of the cultural diversity of animals in changing environments. It might even give insights into the evolution of culture in humans.

Steel by design

Building a more sustainable Europe

Australian and Spanish teamwork is improving the ways steel buildings and bridges are designed, making them safer and greener.

Civil engineer Dr Itsaso Arrayago is the Marie Skłodowska-Curie Actions Fellow at Universitat Politécnica de Catalunya and the University of Sydney. She is collaborating with bridge engineering consultancy Pedlelta who designed the world's first vehicular stainless steel bridge.

Dr Arrayago studied for two years with University of Sydney's Professor Kim Rasmussen, whose pioneering work is changing engineering. His techniques take advantage of sophisticated design modelling and analysis.

"Traditionally, in the first step in the design process, a structural engineer will create a computer model of the building applying loads on the structure and running an analysis," says Professor Rasmussen. "That analysis provides the engineer with the forces in all of the different structural members."

The process is safer, faster and produces leaner structures

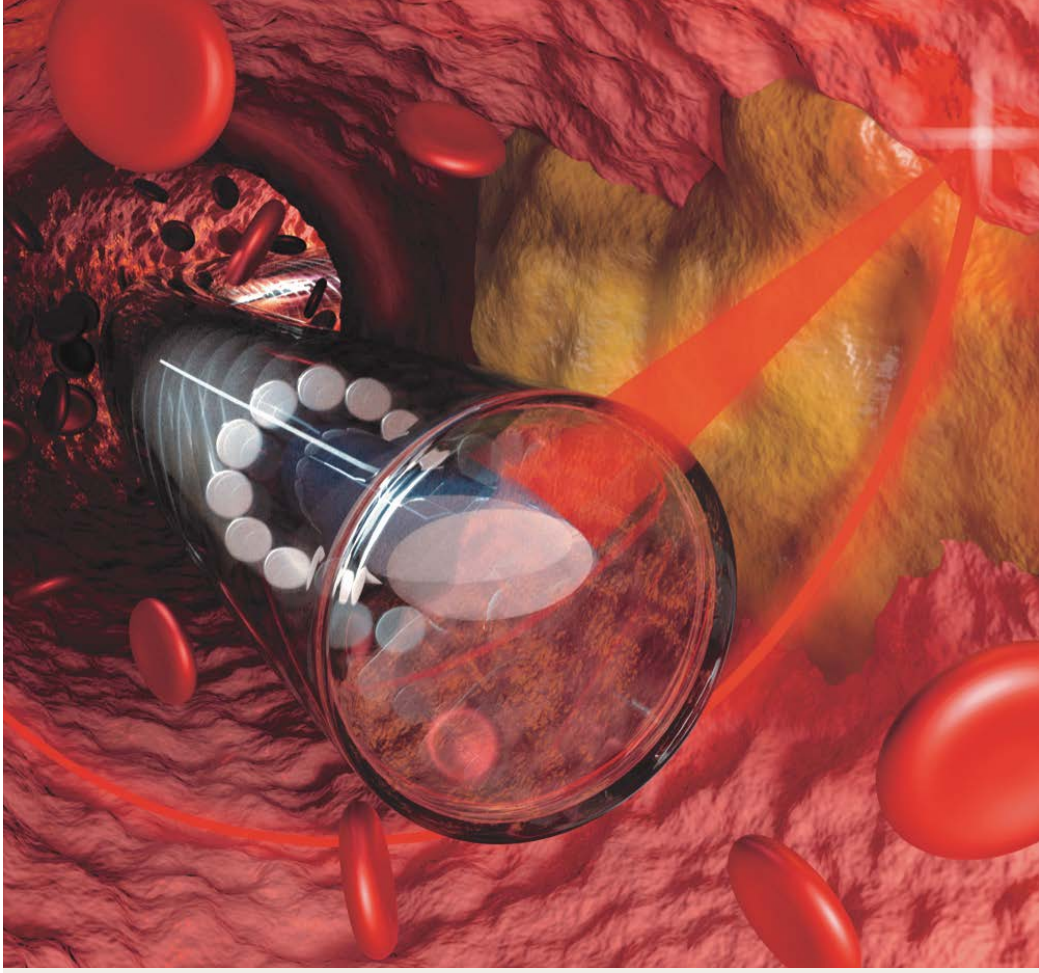
The second step in the process is to check the capacity of each structural member against local construction standards. But the methods of analysis now available to structural engineers have become so sophisticated that they can predict the behaviour and the strength of the entire frame with unprecedented accuracy.

"We know from countless experiments in our structures laboratory that we can get agreement between our predictions and the experimental observations," says Professor Rasmussen.

"So rather than using a simplified analysis and then having to resort to a step two of checking the capacity according to the code, we can do this in one step."

The streamlined process is safer, faster and produces leaner structures.

Professor Rasmussen and Dr Arrayago are now applying these ideas with Pedelta under the Horizon 2020 *New Generation Design Methods for Stainless Steel Structures* project.



Tiny lens looks at hearts

The world's smallest endoscope will soon be predicting the risk of heart attacks

Scientists in Adelaide and Stuttgart are improving heart attack warnings using a new endoscope with a camera lens less than 0.5 mm wide, too small to see with the naked eye.

"A major factor in heart disease is the plaques, made up of fats, cholesterol and other substances that build up in the vessel walls," explains lead researcher Dr Jiawen Li from the University of Adelaide, who worked with a team from the ARC Centre of Excellence for Nanoscale BioPhotonics (CNBP).

Scientists are improving heart attack warnings

"Miniaturised endoscopes, which act like tiny cameras, allow doctors to see how these plaques form and explore new ways to treat them," she says.

"Our device allows cross-sectional visualisation of plaques inside blood vessel walls with high resolution, molecular contrast and sensitivity that are not possible with any other existing technologies," she says.

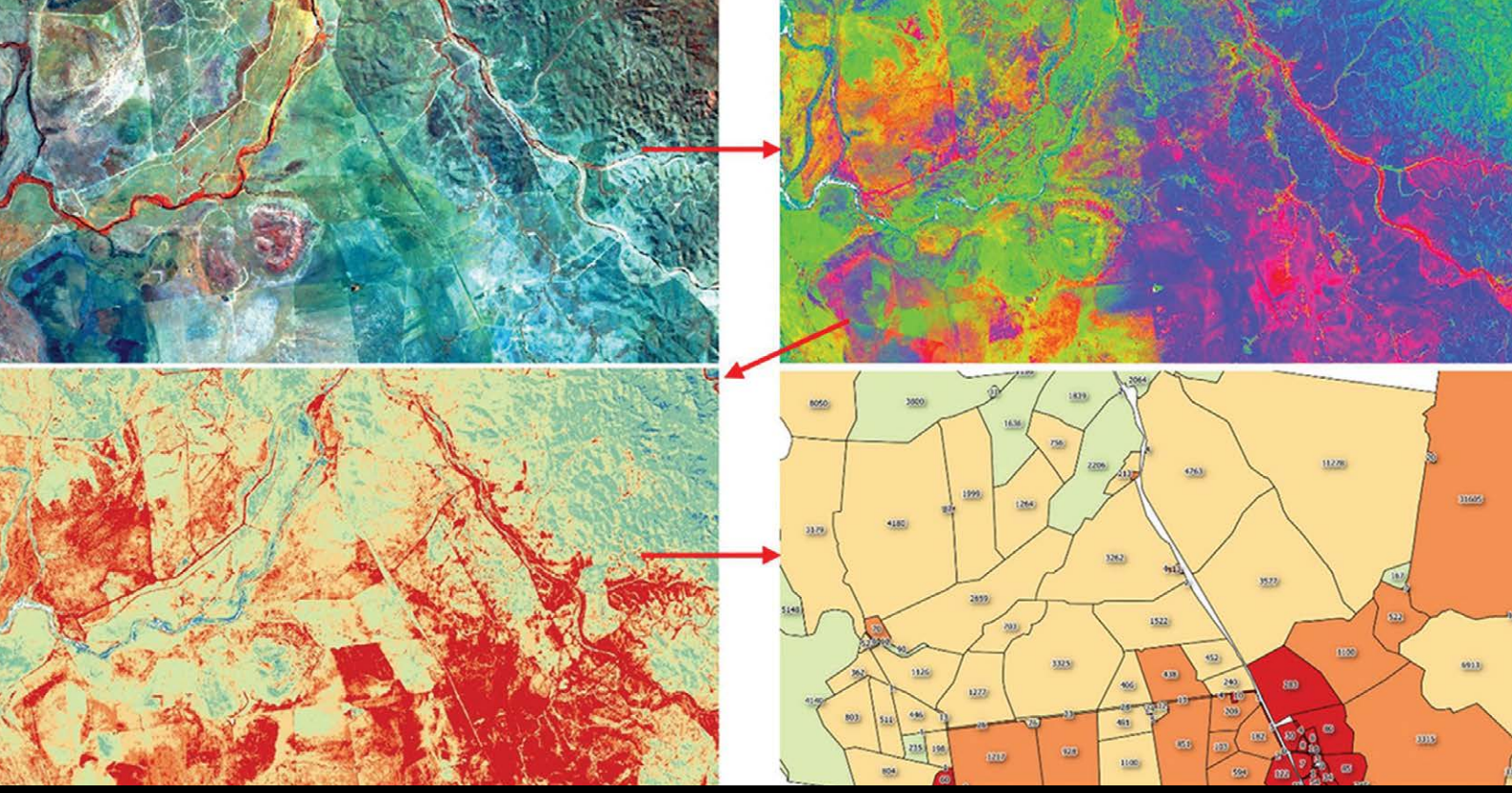
Dr Simon Thiele made the tiny lens at the University of Stuttgart.

"Until now, we couldn't make high quality endoscopes this small," Dr Thiele said.

"Using 3D micro-printing, we are now able to print complicated lenses that are too small to see with the naked eye.

We are now able to print complicated lenses that are too small to see with the naked eye

Photos: The first vehicular stainless steel bridge, credit Pedleta. Minature endoscope, credit Florian Sterl, Sterltech Optics.



Farmers reap space rewards

Eyes in the sky show way to more efficient agriculture

A constellation of EU satellites are helping Australian farmers monitor crop growth, water, and soil nutrients.

The project using the satellite data has been dubbed COALA—Copernicus Applications and services for Low impact agriculture in Australia—and it is funded under the EU's Horizon 2020 program.

"One of the aims was to transfer technology and services that have been delivered and are already working in Spain and Italy and adapt them to Australian conditions," says University of New South Wales Professor Graciela Metternicht who is part of a team of partner companies and universities.

While there are other programs which use satellite data for crop and water management, the beauty of COALA is its data and the frequency with which the Sentinel satellites pass over any fixed point of agricultural land once every five days. That 'revisit' time compares with once every 16 days for Landsat, the US rival to Sentinel. And, Sentinel's data is open source, unlike some other satellite data providers who charge for their data.

The satellites orbit at a height of 800 kilometres above the Earth's surface with an image pixel size –the smallest area they can focus on—of 10 metres squared.

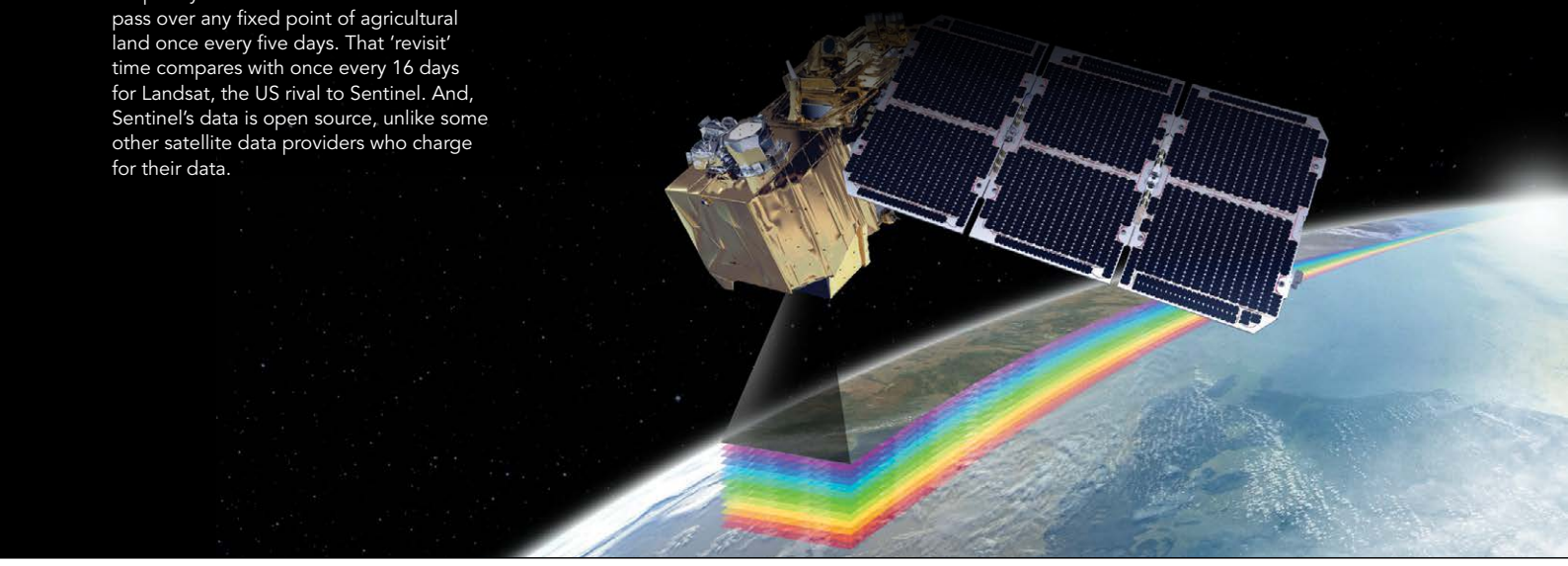
"Each satellite image covers an area of 60 by 60 kilometres, and we can join images together so, once we know the algorithm, we can process hundreds of paddocks at that resolution of 10 metres," says Professor Metternicht.

That means the scientists can advise on crop growing conditions in different parts of a single paddock, identifying where growth is healthiest and the inputs that have made it so. That allows farmers to adjust their practices throughout a growing season.

The European partner researchers in Spain and Italy might be used to similarly dry conditions, but the scale of Australian farms came as a surprise to them.

"The main difference is the size of the paddocks," says Professor Metternicht. "We recently had a review by one of the European evaluators who said the scale at which we are working in Australia blew his mind."

The Sentinel satellites orbit 800km above the Earth's surface



Calcium from millet?

Fortifying crops provides struggling communities around the world with the nutrients they need

Australian plant physiologist and biochemist Professor James Stangoulis is working on the biofortification of crops to make staple foods in the developing world more nutritious.

"While the focus is on nutrition for human consumption, it also has the important benefit of helping to deliver higher yields on nutrient-poor soils," says Professor Stangoulis from Flinders University.

The Food and Agriculture Organisation estimates that around two billion people worldwide suffer from micronutrient malnutrition, and UNICEF says most of the world's children don't eat enough vitamins and minerals.

Professor Stangoulis is a long-time partner of HarvestPlus, an NGO established to develop biofortified crops. and funded by the European Commission.

His previous work has addressed zinc and iron deficiencies, and he is now focussing on calcium.

Helping to deliver higher yields on nutrient-poor soils

Calcium is vital for bones and teeth and helps regulate muscle, nerve and hormone function. In general, 50–70 per cent of dietary calcium comes from animal products, which is a problem for areas where dairy intake is low and grains are a dietary staple.

Millet is promising as a target crop, he says, because it can be drought tolerant.

"Finger millet, a crop with a higher grain-calcium concentration, is a great candidate for learning about mechanisms that contribute to calcium accumulation in grain crops."

A cure for ageing riesling

Germany and Australia protect vineyards from sun damage

It's a good thing to age like wine, so the saying goes, but would you want to age like a wine grape? Not if it's a riesling grape growing under harsh sunshine.

Riesling grapes are struggling with premature ageing, seemingly because of climate change, in parts of Australia where they have previously thrived.

"In recent years young riesling wines have started to show a premature 'aged' character," says Dr Yevgeniya Grebneva, a German scientist working for the Australian Wine Research Institute in Adelaide and the Hochschule Geisenheim University.

For consumers, it will preserve their choice of their favourite riesling style

Although many aged wines are highly valued; in Australia, consumers enjoy riesling's refreshing youthful acidity. Its unique ability to develop aged flavours and bouquet over decades is a more acquired taste.

"As riesling ages, it develops a distinctive aroma of petrol," says Dr Grebneva. "And while that is highly appreciated by connoisseurs in Germany, it is less favoured in Australia, so having these characteristics develop in young wines is a marketing nightmare."

Intrigued by the new ageing problem, she completed her PhD at the Australian Wine Research Institute where she studied the effect of changing vineyard light conditions on riesling grapes to see if that could be the culprit. Sure enough, she found a direct correlation.

"I applied different coloured shade cloth to bunches of riesling grapes at different times during the growing cycle, changing the light reaching the grapes during ripening," she says. "Eventually I was able to optimise the ageing potential of riesling wine without negatively affecting its overall quality."

She hopes her work will help arm grape growers with tools to face some of the viticultural obstacles that come with shifts in growing conditions due to climate change.

For consumers, it will preserve their choice of their favourite riesling style—the light bright high acidity younger wines or the elegantly aged, distinctive bouquet of a wine that has not been forced to mature prematurely.

It's a good thing to age like wine, but would you want to age like a wine grape?

Photos: Sentinel, credit: Copernicus. Professor James Stangoulis, credit: Flinders University.

Optometrist to the stars: MAVIS

A new instrument will give Earthbound astronomers a clear view to rival space telescopes

An ambitious collaboration led by Australian, French, and Italian scientists, together with the European Southern Observatory (ESO) located in Chile, is aimed at fixing the distortion of images from Earth-based telescopes caused by the Earth's atmosphere, by designing a giant pair of "glasses" to correct the vision of the Very Large Telescope (VLT) at the ESO.

A new instrument, dubbed "MAVIS" (MCAO Assisted Visible Imager and Spectrograph), will correct for these distortions in real time, delivering crystal clear images and "3D" data portraits of objects millions of light years away.

MAVIS's images will rival those of the Hubble Space Telescope in detail and clarity, says project scientist Associate Professor Richard McDermid from Sydney's Macquarie University.

"The telescope that we're going to put MAVIS on, which has a diameter of eight metres, can collect more light than Hubble, where the main collecting mirror has a diameter of only 2.4 metres," he says. "The problem is that atmospheric distortions blur the images, meaning we cannot make full use of that larger light collecting ability. That's where the adaptive optics of MAVIS comes in."

The team have an ingenious solution to the problem—using lasers and a naturally occurring phenomenon at the edge of Earth's atmosphere.

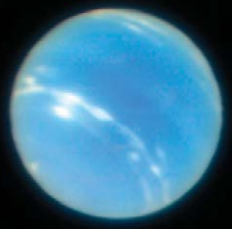
"There is a layer of sodium atoms that are deposited by meteors and meteorites in a naturally occurring layer about 90 kilometres up in the atmosphere.

"By hitting these sodium atoms with a laser at exactly the right frequency of light, we can excite them and they glow orange. We use these glowing beacons of light to measure and correct for the Earth's atmospheric distortions," says Associate Professor McDermid.

The project was first presented as a concept in 2018 and the design is due for approval this year. MAVIS should be in service by 2027.

"It's certainly the most complicated instrument that I've ever worked on," says Associate Professor McDermid. "It's such a delicate operation to work with visible wavelengths of light. Existing adaptive optics systems generally work with infrared light, whose longer wavelengths are less sensitive to optical imperfections. MAVIS works with visible light, like what our eyes see. These wavelengths are much smaller, meaning that MAVIS must be precise on nanometre scales—quite a challenge for an instrument the size of a small truck!"

MAVIS's images will rival those of the Hubble Space Telescope



Adaptive optics

No Adaptive optics

A flagship project will be to investigate intermediate-mass black holes

Scientists get on the same wavelength

What should astronomers look at with the Very Large Telescope?

The new MAVIS instrument can not only take pictures, like a camera, but can also capture 3D information, analysing light waves to build up a "data cube". Light is broken up into its various colours, which can tell us about the motions and chemical content of gas and stars.

A flagship project will be to investigate intermediate-mass black holes, which we currently know little about.

"Black holes made by individual stars exploding or pairs of stars colliding tend to be in the order of tens of times heavier than the Sun. At the centres of massive galaxies, we see evidence of 'supermassive' black holes, which are millions to billions of times heavier than the Sun," says Macquarie University's Associate Professor Richard McDermid.

"But it's the black holes in between these two ranges that we don't really know much about, because they're extremely hard to detect. With MAVIS, we can look deep into the centres of nearby star clusters, where we expect to find these intermediate-mass black holes, if they exist. With the sharp view of MAVIS, we will see the stars moving on the sky over the course of a few years. If they move a lot, they must be orbiting something heavy, and that might indicate the presence of an elusive intermediate-mass black hole."

This is just one of many exciting areas to explore. "With MAVIS, we will resolve distant galaxies, see the Universe's first star clusters in formation, detect planetary systems around other stars, and study volcanic eruptions on the satellites of Jupiter" says Associate Professor McDermid. "MAVIS is a tool that will enable a very broad array of science, in the emerging era of high precision astronomy."

MAVIS is a tool that will enable a very broad array of science

Australia's time machine gets down to business

The ASKAP radio telescope, about 800 kilometres north of Perth, is taking new images of space to help scientists better understand the origins of the Universe.

Professor Elaine Sadler is the principal investigator of an ASKAP project working with European researchers, dubbed FLASH, for First Large Absorption Survey in H1. She and her team are looking for hydrogen in the Universe.

"At the time of the Big Bang, the Universe was essentially made of hydrogen and helium. Hydrogen is still the most common element, and the raw material for making new stars," says Professor Sadler.

The ASKAP telescope works as a time machine looking out into the distant Universe, to see things as they were at the time that the light began to travel.

The ASKAP telescope works as a time machine

"One of the other surveys, dubbed WALLABY, is looking across the whole scope of galaxies that are reasonably near to us, looking at their hydrogen clouds and mapping out places where new stars are forming," says Professor Sadler.

"We're learning about how the hydrogen in the Universe was distributed five or six billion years ago, compared to how it is now," she says.

Photos: MAVIS, credit: Astralis. ASKAP, credit: CSIRO.

Dustbusters get in at the birth of baby planets

Like rocks in a river

The Dustbusters are a group of astronomers from around the world who are using the latest high-resolution telescopes and instruments to study 'baby' planets shortly after they have formed.

Very few of these new planets have been seen, but the Dustbusters' work is pointing astronomers to where they should be looking.

They are using the flow of gas around a young star known as HD97048, about 500 light years away, to get a better understanding of a new planet which is up to three times the mass of Jupiter.

The project is led by the Universita Degli Studi di Milano with 13 collaborators in France, Chile, the USA, UK, the European Southern Observatory, and Monash University in Australia. Together, they are developing numerical algorithms and techniques to better understand how newborn planets react with the gas and dust in their environment.

The process is like finding a submerged rock in a river using the disturbance in the flow of water around it.

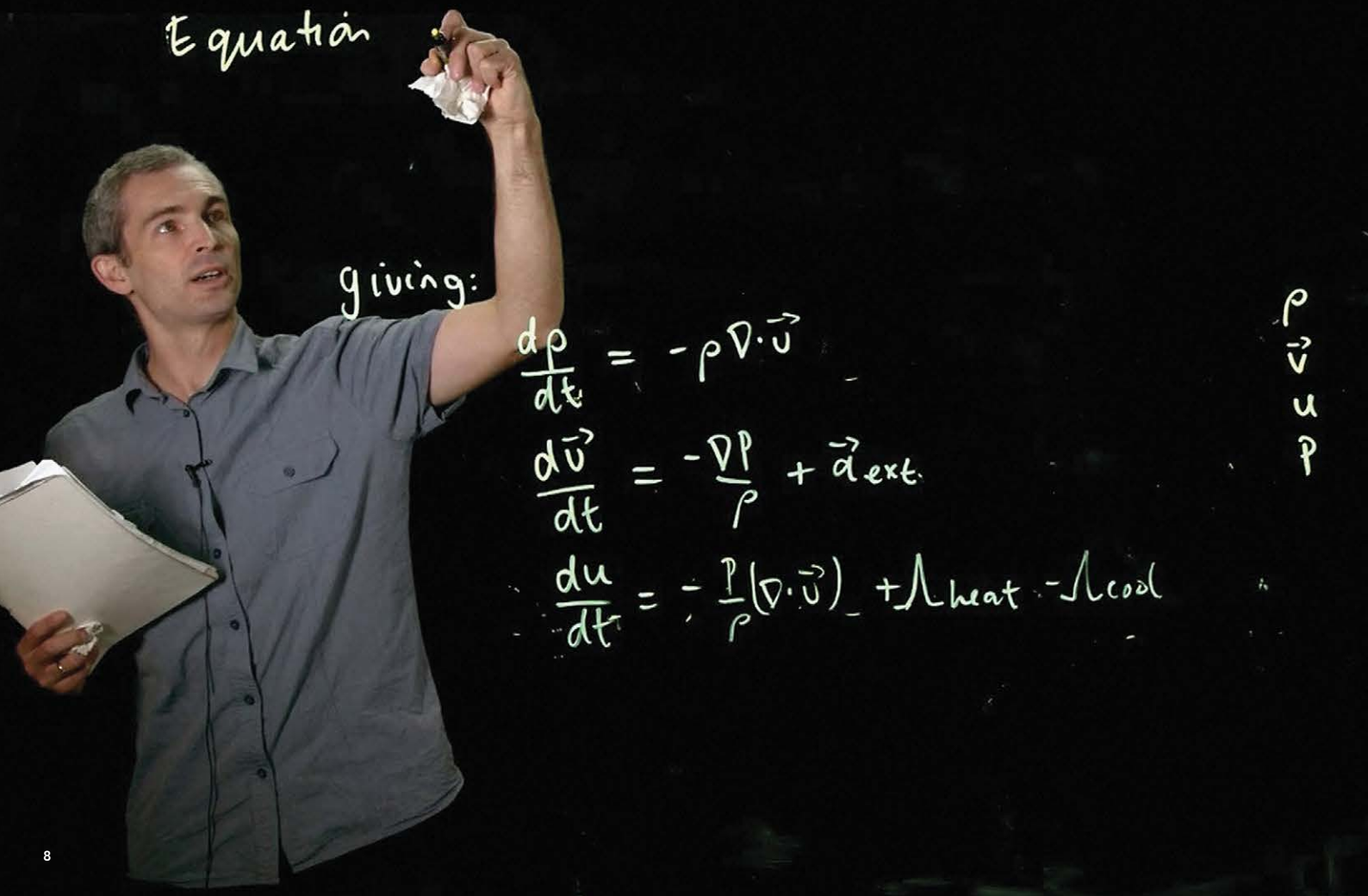
Planet formation is a by-product of the process of star formation itself and occurs within relatively thin and dense discs made of gas and dust that orbit the newborn star.

Pointing astronomers to where they should be looking

Astronomers can now probe these discs with unprecedented detail thanks to telescopes and instruments, such as the Atacama Large Millimeter Array (ALMA) and the SPHERE instrument at the Very Large Telescope (VLT).

These observations can then be used to test 3D simulations of dusty discs. Many basic properties of the discs are not well-understood. The most fundamental issue is the total disc mass, which determines how much material is available for planet formation.

"Our study establishes for the first time, a firm link between baby planets and the gaps seen in discs around young stars," Monash University's Associate Professor Daniel Price, says. "There is a lot of debate about whether baby planets are really responsible for causing these gaps."



A malaria vaccine being developed by Professor Doolan could save half a million lives a year

Vaccination validation

European Union backs Australian malaria vaccine ideas

A malaria vaccine being developed by James Cook University researcher Professor Denise Doolan could save half a million lives a year.

"Malaria is one of the oldest diseases and is probably the disease that has had the biggest effect on the human genome, by driving evolutionary changes," says Professor Doolan. "The sickle cell trait, for example, is a genetic abnormality in the human genome that has arisen in Africa to deal with malaria."

Despite dedicated efforts spanning half a century, a vaccine against malaria has been difficult to achieve, however, because of malaria's complexity.

"The malaria parasite expresses more than 5,000 proteins, and theoretically any one of those could be a good target for a vaccine," says Professor Doolan. "By contrast, if you're looking at a virus, such as the SARS-CoV2 virus, only a handful of antigens are good targets."

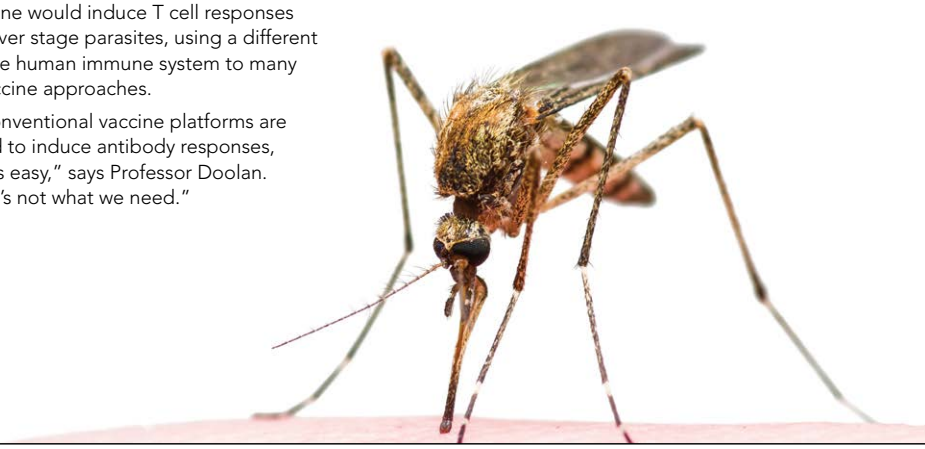
Many researchers have tried to develop vaccines based on a single protein, typically expressed on the sporozoite surface or in the blood stage of the parasite life cycle. But Professor Doolan is taking a different approach, supported by funding from the European Union and Australia's National Health and Medical Research Council (NHMRC).

"My work focuses on the liver stage of the parasite life cycle because an effective vaccine against that stage will stop the clinical disease which occurs in the blood stage, and will stop the transmission of malaria which occurs in the subsequent sexual stage. And my approach is based on the complete genome of the parasite, to identify the set of proteins from the 5000 proteins expressed by the parasite that are the most important ones seen by the human immune system. Many of these proteins have never been studied before, so new approaches and tools are needed to discover them.

A vaccine against malaria has been difficult to achieve

Her vaccine would induce T cell responses against liver stage parasites, using a different arm of the human immune system to many other vaccine approaches.

"Most conventional vaccine platforms are designed to induce antibody responses, and that's easy," says Professor Doolan. "But that's not what we need."



Photos: Dustbuster Danny Price, credit Monash University. Denise Doolan, credit James Cook University.

Copenhagen, Leiden and Melbourne tackle stem cells together

€300m funding from Novo Nordisk Foundation brings together experts to advance stem cell medicine

The potential for new drugs and therapies using human stem cells to treat heart, respiratory and kidney disease, diabetes, cancer, and other conditions are the focus of a new Australian-European collaboration of three research institutes.

The Novo Nordisk Foundation Center for Stem Cell Medicine will be known as 'reNEW' and brings together Murdoch Children's Research Institute (MCRI) in Australia, the University of Copenhagen in Denmark, and Leiden University Medical Center in the Netherlands.

Pioneering Australian scientist Professor Melissa Little, known for using stem cells to create functioning 'mini-kidneys' used to study diseases and treatments, has been appointed CEO.

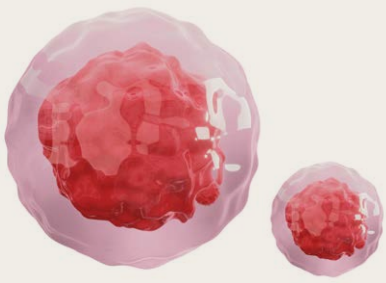
"Stem cell research has come so far," says Professor Little. "Right now we are producing beating heart tissue that may be able to treat children with congenital heart disease. But we're really only scratching the surface."

Cardiac stem cell researcher Professor Enzo Porrello will be Director of reNEWS's Melbourne team, overseeing the centre's research at MCRI and continuing his own work developing patches of heart tissue that can contract to provide extra blood-pumping power to people with heart conditions.

Professor Little is known for using stem cells to create 'mini-kidneys'

"I'm really excited about the development of engineered heart patches," Professor Porrello says. "Over the next few years, we want to move that work forward to a point where we've established it's safe and effective in large animal trials. Then we can begin to think about taking that into the clinic for human trials."

The centre was made possible through a record stem cell medicine grant of up to €300 million over 10 years from the Novo Nordisk Foundation, an international philanthropic foundation based in Denmark, which focuses on medical treatment and research.



The physics of cancer

Can we measure the physical forces at play as cancer cells move around the body? And can we influence those forces to create new treatment options?

An international team has developed a non-invasive way to measure the physical forces at play as cancer cells move within tissues. Their work has led to clinical trials to determine if these measurements can be used to guide treatment.

Examine the efficacy of actively manipulating the cancer environment

The 'FORCE, Imaging the Force of Cancer project was a Horizon 2020 project led by King's College London, with academic and business partners from across Europe and the USA, plus the University of New South Wales (UNSW) and Neuroscience Australia.

Most cancer deaths are caused by the cancer spreading from its primary source throughout the body—a process known as metastasis.

Despite that, there has been surprisingly little work done on indicators for the potential for cancers to spread. Cells use 'traction forces' to perform various tasks, including maintaining cell shape and moving within tissues.

Scientists believe those forces and so-called interstitial fluid pressure (IFP) at the edges of a tumour could be useful indicators that a cancer is likely to spread, but we lack a non-invasive way to measure these forces.

The FORCE project was designed to give better insights into cancer forces but also examine the efficacy of actively manipulating the cancer environment.

Professor Lynne Bilston from UNSW, who took part in the project, has been developing novel methods for measuring biomechanical properties and behaviour of soft tissues in humans, particularly using Magnetic Resonance Imaging and rheometry.

The FORCE project developed a new technology, Magnetic Resonance Force (MRF) Imaging, a non-invasive technique that directly assesses the Stiffness Load Relation of tissue, providing a picture of the forces active within tumours.

The team demonstrated that they could measure and manipulate cancer forces in a patient, providing a new way to predict metastatic potential and determine the best treatment for each cancer patient. Clinical trials are underway.

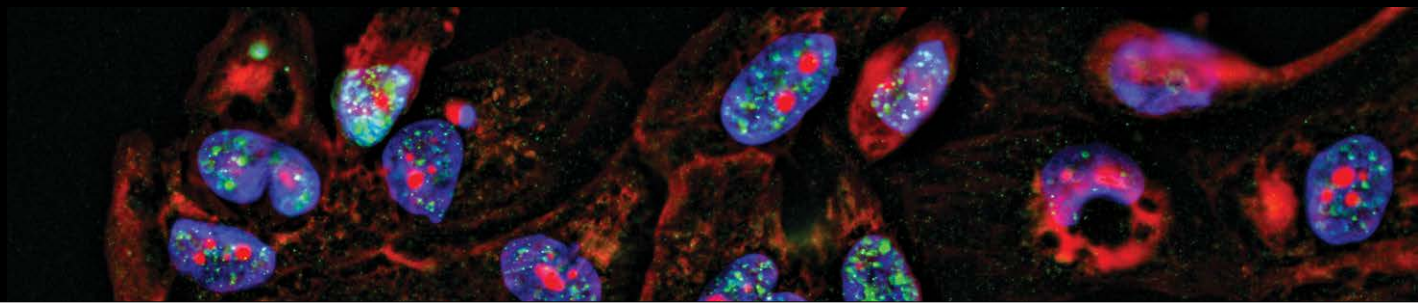
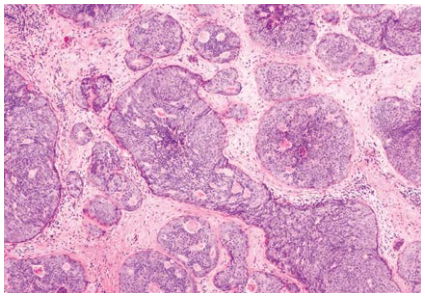


Photo: Professor Melissa Little, credit: MCRI.

The identification of women at high risk of the disease could be a gamechanger



Breast cancer risk

A new breast cancer warning tool enters clinics

Identification of women at high risk of breast cancer could boost survival rates and even avoid the development of the cancer all together.

In a large global project, scientists bridged the gap between geneticists and epidemiologists and between Australia and Europe in a collaborative project to improve breast cancer risk prediction.

BRIDGES, or Breast Cancer Risk after Diagnostic Gene Sequencing, a Horizon 2020-funded project run by the Leiden University Medical Centre in The Netherlands, brought together experts from different fields: from clinical genetics, epidemiology, bioinformatics, statistics, and gene biology.

Australian researchers from QIMR Berghofer Medical Research Institute and the University of Melbourne were amongst the 17 participating institutions, with support from the National Health and Medical Research Council.

Working with clinical information from 120,000 people BRIDGES refined our knowledge of 'breast cancer genes' and developed an algorithm combining different risk factors, such as BMI and hormone levels, into a single risk score: the Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm (BOADICEA).

"The results of our study have been incorporated into an online tool called CanRisk," says the BRIDGES coordinator, Professor Peter Devilee of the Leiden University Medical Centre.

Identification of women at high risk could boost survival rates

"The tool is intended mostly for healthy women who would like to prevent breast cancer development. This includes, for example, women who suspect they are at risk and are considering preventive measures such as prophylaxis, more intensive screening, or lifestyle adaptations," he says.

Dreams come true

AI could bring a better night's rest

Artificial intelligence could be used to create personal treatment plans for many of the billion people suffering with sleep apnoea.

"An increase in the number of patients will pose challenges to health care and its resources," Professor Juha Töyräs, Head of Biomedical Engineering at the School of Information Technology and Electrical Engineering at University of Queensland, and Professor of Medical Physics and Engineering at University of Eastern Finland.

Personal treatment plans for many of the billion people suffering with sleep apnoea

"It is, therefore, important that the project also takes into account therapeutic perspectives and explores the cost-effectiveness of the entire chain of examinations and care."

The AI project, which runs to 2025, aims to draw up new international guidelines for the diagnosis of sleep apnoea using a patient database of more than 30,000 sleep recordings collected in hospitals and research centres, augmented by sleep questionnaires and data from consumer products, such as smartwatches.

Sleep apnoea has been associated with an increased risk for stroke, cardiovascular diseases, and Type II diabetes. It also erodes productivity, quality of life and even road safety.

This Horizon 2020 project is being led by Reykjavik University and involves 37 partners across the world including the University of Queensland.

An old vaccine for new diseases?

The tuberculosis vaccine BCG may help protect against other allergies and infections including COVID according to the latest publications from the BRACE trial.

Trials suggest the Bacille Calmette-Guérin vaccine targeting tuberculosis improves the performance of the innate immune system, which is our first line of defence, at least in babies.

The study was expanded during the COVID-19 pandemic to see if BCG also offered protection against SARS-CoV2, in a collaboration between European researchers and Professor Nigel Curtis and his team at the Murdoch Children's Research Institute in Melbourne.

"At the end of 2019 we thought that it would take at least two years to make a vaccine so we thought, while we're waiting for these vaccines, we could at least try to protect healthcare workers on the front line by boosting their immune system," says Professor Curtis.

"But within a few months, it became very obvious that Australia, with low infection rates, was exactly the worst place to be doing a COVID-related trial.

"With the support of the Gates Foundation, we rapidly expanded to Europe because at that stage, the COVID peak was in Italy and the UK."

Using the methodology established in Australia, trial sites were set up in the UK, the Netherlands, Spain and, later, Brazil. In total there are over 35 sites with over 7,000 participants.

"The study has also allowed us to collect an enormous amount of data that allows us to understand, not just how BCG might work, but also a bit more about why some people get severe diseases and some don't," says Professor Curtis.

Protection for healthcare workers

Photos: Juha Töyräs, credit: UQ. BCG research and Nigel Curtis, credit MCRI.

55 interventions tested, with over 11,000 patients in over 360 hospitals across 21 countries

Aspirin may aid long-term survival from severe COVID

The latest result from a global trial designed for pandemics

REMAP-CAP, a long-term study established by Monash University researchers and backed by the European Union, is continuously updating the best set of treatments for COVID patients in intensive care.

The trial's research into blood-thinning drugs, such as aspirin, found that they were not of much value as an acute treatment but, promisingly, COVID-19 patients given them were more likely to survive in the following three months.

The REMAP-CAP trial design delivers fast results by simultaneously evaluating multiple treatments. It was designed to tackle life-threatening pneumonia, which can overwhelm intensive care units during pandemics. It was initially a response to issues that arose during the 2009 swine flu pandemic. The team turned rapidly to the challenges for COVID patients in February 2020.

The design of REMAP-CAP makes it ideal in a pandemic as it can quickly assess many options, often finding the most optimal use of certain treatments.

"We need to identify interventions that can reduce mortality and reduce ICU length of stay," says Professor Steve Webb, who is both an ICU clinician at the Royal Perth Hospital and a Monash University researcher.

"In the ICU a clinician can enrol a patient in less than five minutes, and they can choose from a smorgasbord of treatment options customised for their intensive care unit."

The European Union was the first major supporter of REMAP-CAP, followed by Australia's National Health and Medical Research Council, the Health Research Council of New Zealand, the Canadian Institutes of Health Research, the Irish Health Research Board, and the UK National Institute for Health Research.

REMAP-CAP's Australian investigators include Steve Webb, Allen Cheng, and Alistair Nichol, all from Monash; Ed Litton (UWA); Jeff Presneill (University of Melbourne); and Peter Kruger (University of Queensland). They are working with leading clinicians and researchers from Canada, the US, Saudi Arabia, Germany, the Netherlands, France, Ireland, and the UK.

REMAP-CAP is an adaptive clinical trial built to deliver fast results in a pandemic

REMAP-CAP

Laser light waves point the way to super-accurate measurements

Scientists in Australia and Scotland have discovered a new way to use lasers for measurements, which brings a level of quantum precision never before available.

The improved sensitivity will enable the next generation of sensors with a wide variety of optical and quantum technologies.

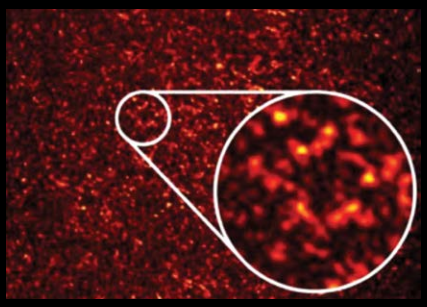
"We have used the wave properties of light to create grainy patterns due to interference, termed 'speckle', which offers a sensitive probe of both the light and the environment," says Professor Kishan Dholakia, who is jointly at the School of Biological Sciences, University of Adelaide, and the School of Physics and Astronomy, University of St Andrews.

Professor Dholakia worked with Morgan Facchin and Dr Graham Bruce from the University of St Andrews to 'scramble' light into a grainy pattern. They used two techniques—a piece of glass fibre the width of a human hair, and a hollow sphere where the light bounces around many times before emerging.

"If you shine a laser pointer on a rough surface like a painted wall, or a piece of frosted sticky tape, the light from the laser gets scrambled into a grainy speckled pattern, said Professor Dholakia.

"If you move the laser, the exact pattern you see will change dramatically. It is this sensitivity to change that makes speckle a good choice for precision measurement."

The technique can measure the wavelength of light at the precision of an attometre—the equivalent to measuring the length of a football pitch with an accuracy equivalent to the size of one atom.

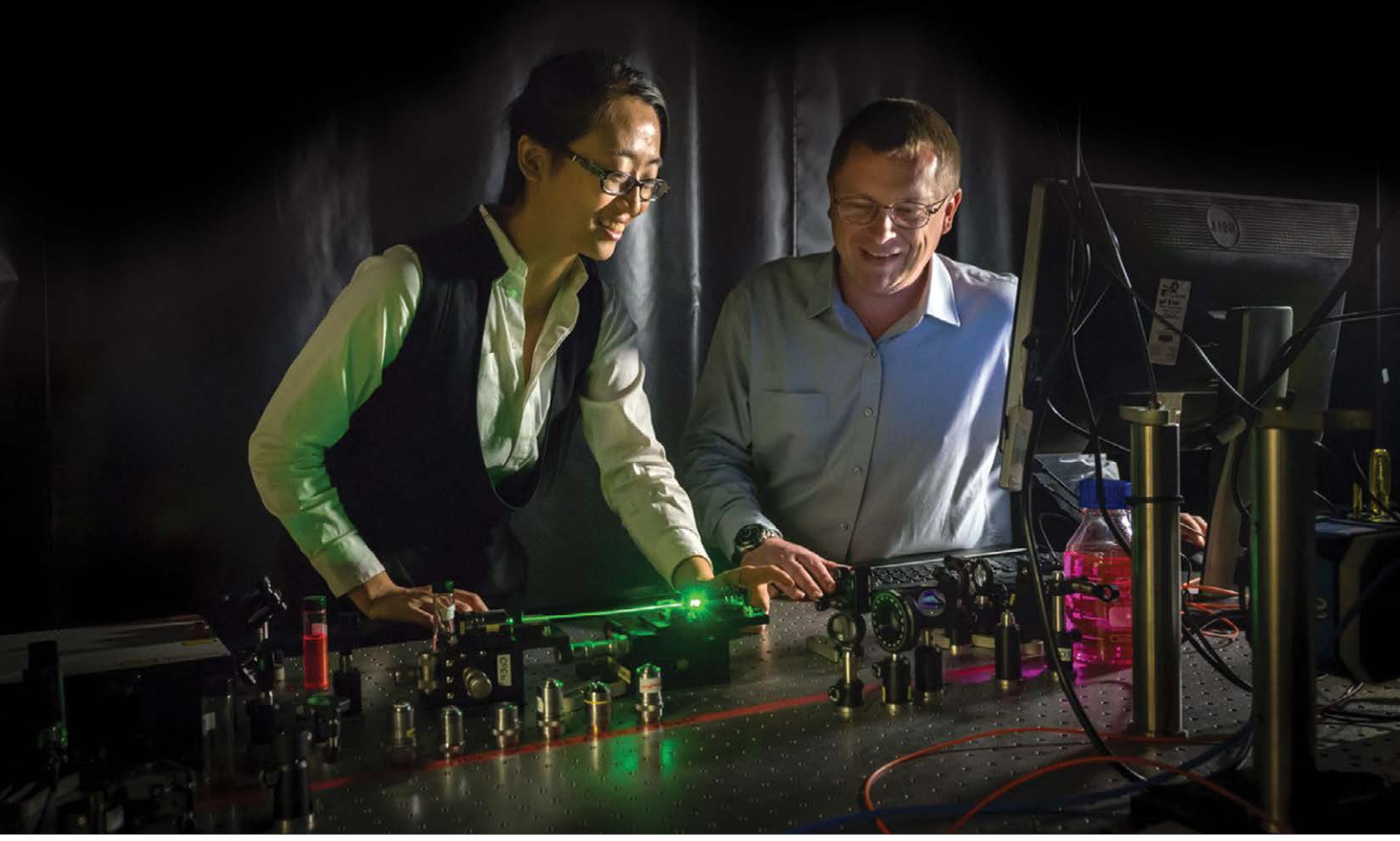


A level of quantum precision never before available

New measuring devices made possible by the technique may have a variety of uses including in healthcare, he says.

Infection can cause changes in the refractive index of your red blood cells, which could be picked up by a sensor this sensitive.

Other potential applications are field portable sensors to detect trace gases or small concentrations of chemicals in liquids.



Photos: Laser team and laser speckle, credit: University of Adelaide.

Mammoth discovery

Prehistoric animals should have survived for 4,000 more years

"Humans were a crucial and chronic driver of population declines of woolly mammoths," says Damien Fordham from the University of Adelaide's Environment Institute.

His research, as a member of an international team of scientists led by researchers from the University of Adelaide and University of Copenhagen, debunks the popular theory that a warming climate critically reduced mammoth populations, leaving so few that humans merely picked off the last survivors at the end.

Humans were a crucial and chronic driver of population declines

"Until now, it has been difficult to disentangle the exact roles that climate warming and human hunting had on extinction," said Associate Professor Fordham.

While scientists knew humans exploited woolly mammoths for meat, skins, bones, and ivory, the new research finds that people were essential in the timing and location of the mammoths' extinction.

"Using computer models, fossils and ancient DNA we have identified the very mechanisms and threats that were integral in the initial decline and, later, extinction of the woolly mammoth," Associate Professor Fordham says.

The researchers point out that pathways to extinction start long before the death of the species' last individual. They found that the seeds of the mammoth's fate were probably sealed 20,000 years or more before their ultimate demise.

"We reconstructed the whole extinction pathway over a period of 21,000 years in Eurasia—all of Europe, Asia, Russia, Pakistan, Mongolia—a really big chunk of the Earth," Associate Professor Fordham says.

However, changes in the distribution of woolly mammoths from fossils and ancient DNA suggest that, in some regions, people hastened the mammoths' extinction by up to 4,000 years.

When humans were taken out of the simulations entirely, the mammoths hung on for longer.

"In some places they may have been able to hold on in the future for much, much longer and potentially closer to the present day... in pockets of northern Siberia where they could take refuge."

Bone of contention

People lived in Europe 10,000 years earlier than previously thought

"It was a great surprise to the team when a modern child's tooth and stone tools, which in no way were associated with Neanderthals, were discovered in a soil layer dating back 54,000 years ago," co-author of a recent study, Dr Martina Demuro from the University of Adelaide, said.

Previously it was believed the Neanderthals had the continent to themselves until 45,000-43,000 years ago.

Distinctive stone tools were found alongside *Homo sapiens*, in Grotte Mandrin—a cave in the Rhône Valley, not far from Marseille. Tools of this antiquity had only previously been seen before in Africa and the Levant.

This study drastically changes our knowledge of when modern humans strayed into Europe

They were sandwiched in a layer containing earlier Neanderthal remains and one with later Neanderthal remains associated with the so-called Mousterian style of stone tools commonly found across Europe at the time.

The find indicates that modern humans and Neanderthals may have alternated occupation of the cave while co-existing in the same area over a long timeframe. While there is no evidence yet that they crossed paths in the cave, it does challenge the theory that modern humans simply replaced Neanderthals in Europe in one sudden event.

Homo sapiens emerged in Africa more than 300,000 years ago and the first early modern human remains have been found outside Africa in Israel at 194,000 to 177,000 years ago, in East Asia as early as 80,000 years ago, and in Australia from around 65,000 years ago.

"This study drastically changes our knowledge of when modern humans strayed into Europe," says Dr Demuro.

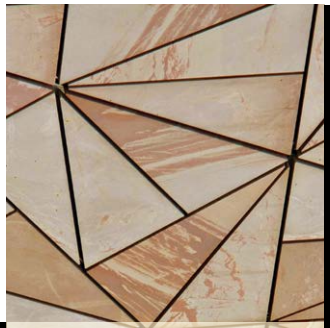
Dating of the Grotte Mandrin artefacts was corroborated using multiple dating techniques, including single-grain dating of sediment performed at the University of Adelaide.

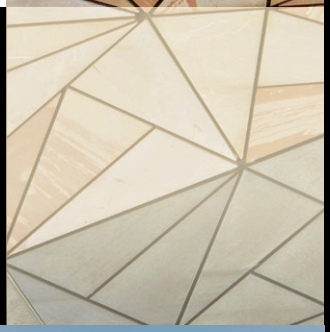
Australian astronomers have been awarded time on the European Southern Observatory's Very Large Telescope (VLT). It will enable them to lead international teams of astronomers to perform deep observations of the Milky Way's galactic cousins and reveal the physics of star formation and galaxy evolution in some of the most massive structures in the Universe. The projects are led by Jesse van de Sande from the University of Sydney, and by Barbara Catinella and Luca Cortese from the International Centre for Radio Astronomy Research at the University of Western Australia. The VLT is in the Atacama Desert of northern Chile, one of the driest places in the world.

Credit: John Colosimo (colosimophotography.com)/ESO

Photos: Wooly mammoth, credit https://mauricioanton.wordpress.com. Damien Fordham, credit University of Adelaide. Stone axe, credit Martina Demuro.

EUROPEAN UNION
Delegation to Australia





Stories of European-Australian Research

The European Union (EU) invested more than $115 billion in science and innovation through the Horizon 2020 Programme for Research and Innovation (2014–2020). The 'Horizon' programs for science, research and innovation are open to the world, which means researchers from any country can participate in most calls.

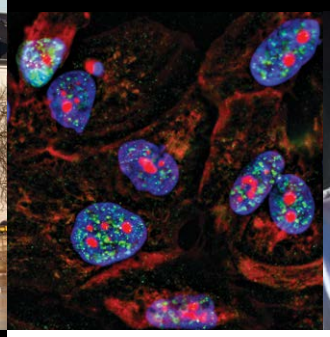
The EU invested over $20 million in Australian research and innovation through Horizon 2020, supporting projects from ocean wildlife monitoring and hypersonic flight to CubeSat swarms and bushfire defence.

The European Research Council has supported more than 48 Australian researchers based in Europe and, since 2007, more than 590 Australians researchers have taken part in the Marie Skłodowska-Curie actions which also support interdisciplinary mobility.

Funding research and innovation, science and scientists, encourages the pooling of international resources and inspires researchers to create a more knowledge-intensive society and discoveries for future generations.

Stories of European-Australian Research shows some of the depth and diversity of research collaborations between Europe and Australia, which continue to flourish under the Horizon Europe programme which is investing nearly $150 billion over the period 2021-2027.

For more information look up Horizon 2020 or Horizon Europe at the EU's funding and tenders web portal, or search EURAXESS for jobs and funding opportunities in Europe and Australia.



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