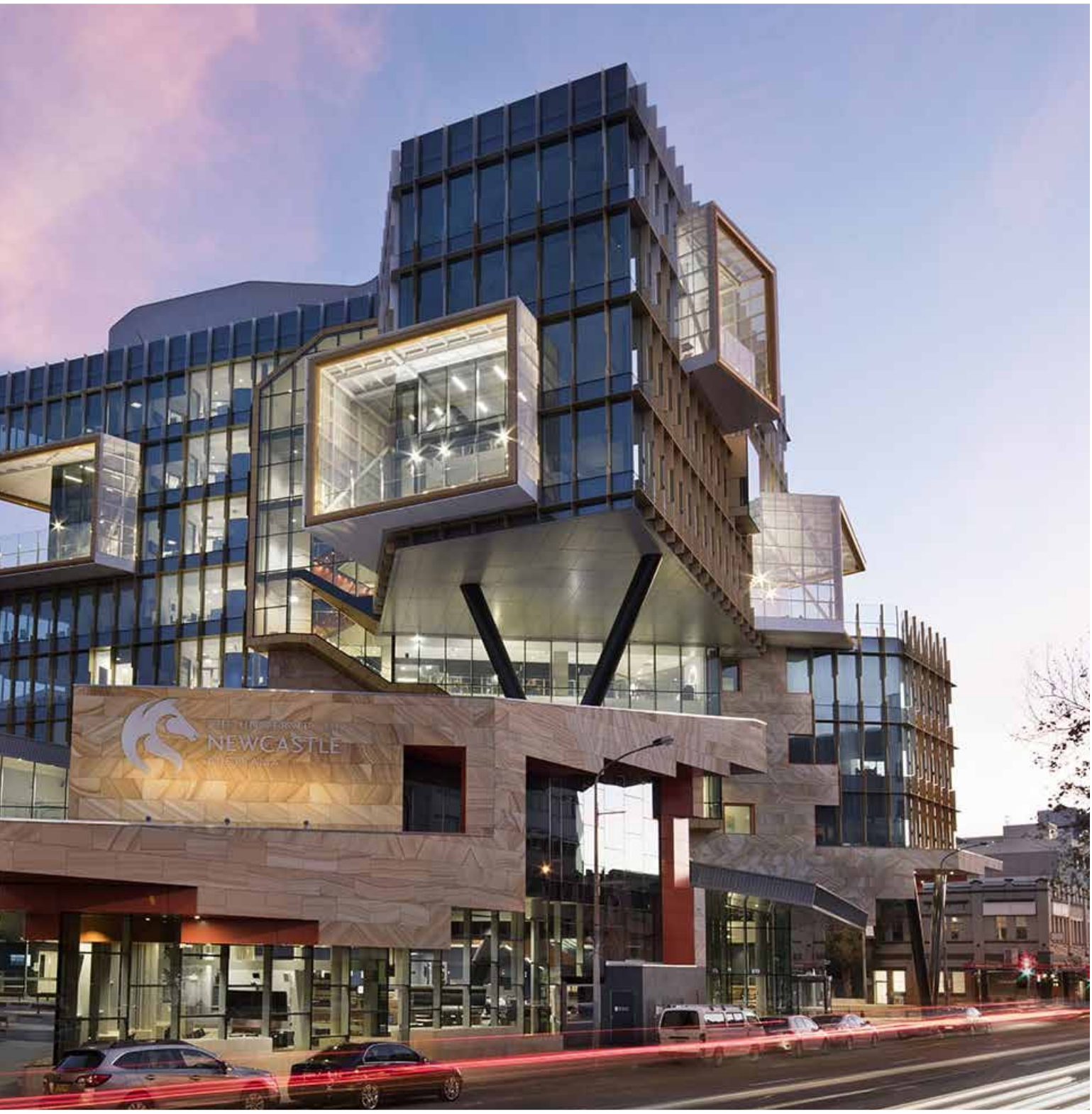
AUSTRALIAN TECHNOLOGY NETWORK
OF UNIVERSITIES

THE UNIVERSITY OF NEWCASTLE
AUSTRALIA

Built on the principles of equity, excellence and engagement, the University of Newcastle has a reputation as a world-class institution making an impact within its own region, throughout Australia and across the globe.

Our research is world-class and diverse. Our degree programs are internationally recognised and our partnerships and collaborations drive innovation. Our alumni are leaders and our students are preparing to make a difference in the world.

We are ranked in the top three per cent of universities world-wide and we have only just turned 50.


NEWCASTLE

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Printed solar cells

A new paradigm for renewable energy technology and job creation

- **New ultra-thin flexible solar cells are poised to create jobs and drive manufacturing diversification**
- **Rapid production will improve access to solar cells and reduce power bills**
- **Education and training capability will equip workers for tomorrow's jobs**

A new era of solar energy is about to dawn, thanks to a University of Newcastle team who has created printable solar cells that are as light-weight and flexible as a chip packet. Made from recyclable polyethylene terephthalate (PET) and manufactured on conventional printers, the solar cells cost only $10 per square metre to produce, which helps overcome the cost and waste barriers of conventional solar panels.

The first commercial-scale pilot took place in 2018 when the university partnered with CHEP – a global supply chain solutions company – to install 640 meters of printed solar panels on CHEP's Hunter Valley facility. As the next step to test durability and accelerate full commercialisation, the University of Newcastle team has installed a vivid and immersive lighting experience at 'The Canopy', a new urban space in Lane Cove, Sydney. The public will have a unique opportunity to interact with this inspiring science and ground-breaking technology, positioning renewable energy solutions as accessible for ordinary Australians and sparking the imagination about where STEM studies can lead.

Printed solar is faster than any other renewable technology to manufacture, with commercial-scale printing equipment capable of producing kilometres of material per day. This presents opportunities for conventional printing companies whose business has been disrupted by the rise of digital technologies. The world-class manufacturing facility at the university's Newcastle Institute for Energy and Resources (NIER), supported by the Australian National Fabrication Facility, is already at capacity, making manufacturing expansion a priority. The university also has the capability to develop the education and training framework that will support this emerging sector and train the new workforce.

In line with the objectives of the Australian Government's 'Technology Investment Roadmap' (May 2020), this project delivers more than just emissions reduction – it develops technology that will support jobs growth. There are endless potential applications for this flexible, wrap-able product, from defence settings, to building cladding, charging stations for electric cars and floating covers for dams and pools.

◀ *Paul Dastoor*

Quality Teaching

A proven approach to enhancing teaching performance and accelerating student outcomes

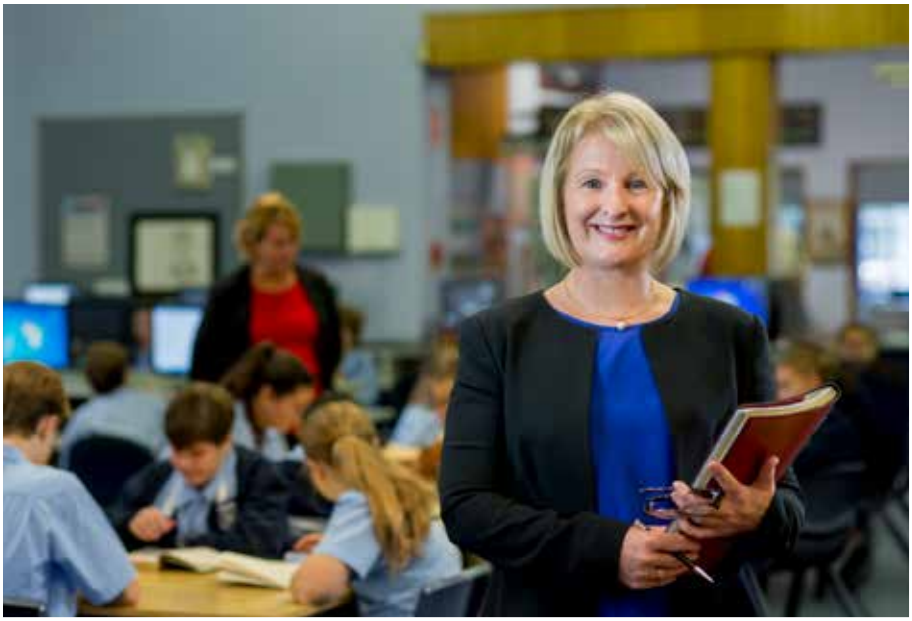
- **Evidence-based approach informs improved teaching performance and boosts professional morale**
- **Students benefit from measurable improvements, enabling rapid recovery from educational disruption**
- **Dramatic improvements to maths teaching and student outcomes, supporting national STEM goals**

The link between high-quality teaching and positive student outcomes is indisputable, yet until now there has been little reliable evidence that shows positive impact from the plethora of teacher professional development programs. Over the past 15 years, rigorous research by the University of Newcastle, led by Laureate Professor Jenny Gore, has delivered the Quality Teaching (QT) model and Quality Teaching Rounds (QTR) program. There is now both anecdotal and measurable evidence of the tangible positive impact these have had on teacher development and student advancement, supporting evidence-based education policy.

The QT model provides teachers with a tested conceptual framework for articulating, sharing, assessing and refining their practices. It helps teachers understand what it means to teach well. The QTR program follows the model of medical teaching rounds, a carefully designed process that enables teachers to share advice and use rich collaborative processes to improve their teaching practice across any subject or grade. The QT model has been applied in over 2600 government, Catholic and independent schools in NSW and the ACT and has also informed education policy in South Australia. More than 250 schools have trialled the QTR program, benefiting 150,000 students, and directly correlating to positive impacts on NAPLAN results.

A $16.4 million grant in 2018 from the Paul Ramsay Foundation will expand QTR to reach an additional 30,000 teachers over the next five years. It also funded a study in 2019, supported by the NSW Government, on the impact of QTR on students and teachers in a range of contexts. The initial findings show a remarkable 25% improvement to student learnings in maths, equivalent to an additional two months learning in less than a year. The academic gains were slightly greater in disadvantaged schools and these results are likely to be replicated for other subjects.

As schools and students grapple to recover from the educational disruption of COVID-19, this dramatic acceleration is highly significant. Other measurable improvements to teacher morale, performance and collegiality enhance the attractiveness of the profession and support the national goal of increasing participation and success in STEM subjects.



Professor Jenny Gore ▶

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Hone Global

Putting real-time decision making in the palm of farmers' hands

- **Empowering farmers with real-time data insights to improve productivity and save costs**
- **Enabling the agriculture sector to adapt to a changing climate and compete globally**
- **Creating commercial value and jobs by translating advanced spectroscopy and chemometric science into intelligent software**

In 2016 three University of Newcastle PhD students created Hone Global – a digital platform that uses patented technology to put real-time analysis of crops and soils in the palm of farmers' hands, thereby helping them save time, effort and money. It gives farmers direct access to laboratory standard chemical analysis from their own paddocks, empowering their decision making.

Hone's patented platform attaches to the back of a smartphone and uses advanced spectroscopy techniques to assess the chemical traits of any solid or liquid. Data is transferred to Hone's cloud-based, artificial intelligence chemometric platform using a specially-designed smartphone app. Within seconds, quantitative and qualitative insights are delivered to the user's smartphone so farmers, winemakers, brewers and others in the agribusiness supply chain can make real-time decisions that improve soil health, produce quality and production processes.

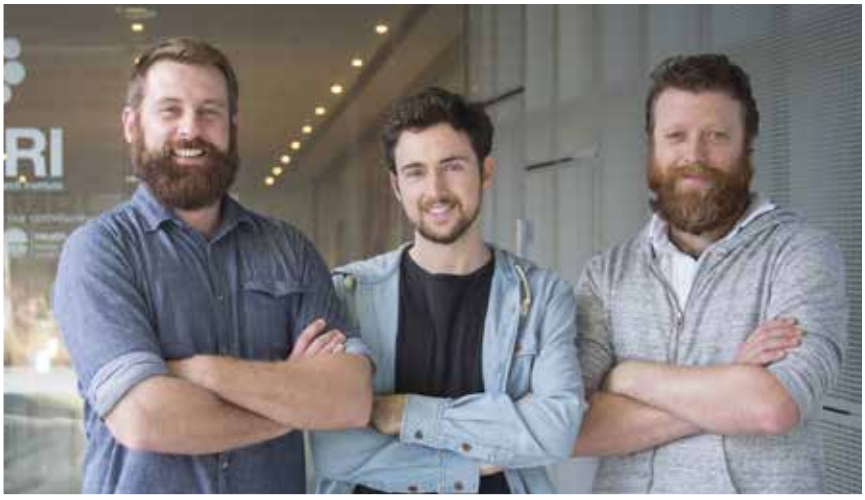
Hone engaged industry-leading laboratories to help develop a suite of applications on its platform to enable testing of soil, leaf, grain, feed, and other samples in a fraction of the time of traditional off-site laboratory methods. The real-time nature of Hone means producers can take earlier action to improve performance and yield. By instantly knowing the quality of their produce, farmers are empowered to optimise water, fertiliser and storage capabilities and intelligently trade their commodities to increase their margins.

All of this can lead to increased confidence among growers to meet escalating national and international produce demands, quality and environmental expectations.

Importantly, Hone offers significant cost benefits, with costs averaging $1 per test on the Hone platform compared to an average of $100 per sample using traditional laboratory methods.

Today, they have over 450 users, have conducted more than 345,000 sample tests, and have worked with national and international agribusiness partners such as Cargill, GrainCorp, Ridley, AMPS Agribusiness, the Australian Wine Research Institute, the NSW Department of Industry, and the International Crop Research Institute for the Semi-Arid Tropics.

Hone has several other patent applications pending and maintains a one-of-a-kind machine learning chemometrics platform. It employs 15 staff and is developing additional applications for its technology, including environmental testing, water testing and medical devices.



◀ *Hone founders*

Viralytics

Using the cold virus to kill cancer cells

- **Translating 20 years of pioneering research into real clinical benefits for patients with advanced cancers**
- **Lessons learned from successful biotech spinout applied to new university venture**
- **Australian biotech advances on the world stage**

While traditional cancer treatments have improved over time, they still come with serious and sometimes debilitating side effects. Their effectiveness also varies depending on the type and stage of the cancer. A new treatment approach is immunotherapies, which essentially introduce viruses to induce an immune response against cancerous tissues. Immunotherapy represents a new paradigm in cancer treatment, has fewer side effects, and is proving to be particularly useful in late stage and metastatic diseases where conventional therapies fail.

Professor Darren Shafren's research into the common cold led to a major immunotherapy breakthrough and one of the largest biotech acquisitions in Australian history. Shafren was originally investigating ways to prevent the cold virus from binding to molecules in the lungs, nasal passage and respiratory tract. In 1999, he was approached by a colleague trying to find new ways to kill melanoma cells in the laboratory setting. On a whim, Shafren suggested using the airborne virus Coxsackievirus A21, one of the causes of the common cold. It obliterated the melanoma cells.

Later that year the University of Newcastle helped Professor Shafren patent the use of CAVATAK® in oncology and found the company Viralytics. With support from the university, Professor Shafren spent nearly 20 years guiding his experimental drug through various clinical trials.

In 2018, pharmaceutical company MSD (a subsidiary of US-based pharmaceutical giant Merck & Co., Inc.) acquired the Australian virotherapy firm Viralytics and the rights to its cancer-busting drug CAVATAK® for AU$502 million.

Clinical trials involving CAVATAK® as a stand-alone treatment have consistently shown significant tumour reduction. The drug has also been highly effective in combination with other immunotherapy drugs. CAVATAK® is currently being investigated in Phase 1b clinical trials in combination with checkpoint inhibitors for patients with advanced melanoma, lung cancer and bladder cancer. These are highly prevalent cancer types in the United States and Australia.

In 2020, Shafren became the Chief Scientific Officer in a new private venture backed by the University of Newcastle called ImmVirX, that aims to develop even more cutting-edge cancer therapies to improve outcomes and quality of life for cancer patients worldwide.

Professor Darren Shafren ▶