

# Lab+Life SCIENTIST



HONEYBEE  
VENOM  
**KILLS CANCER  
CELLS**

**DIET**  
AND STROKE RISK

**HIGH-SPEED**  
SPECTROSCOPY

OCT/NOV 2020  
VOL.31 NO.4  
PP100008671

ANALYTICAL | BIOTECH | ENVIRONMENTAL | INDUSTRIAL | LIFE SCIENCES | MEDICAL





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# Life, the universe and everything

The Australian Government may have committed to the purchase of several potential COVID-19 vaccines candidates, but there's a long way to go before any of them will be approved for widespread use and distribution. So how do you distract yourself when the entire world is fixated on a seemingly never-ending pandemic? Look to other worlds, of course!

Yes, at the time of writing Australia has just ratified the Square Kilometre Array (SKA) Observatory Convention, bringing the country one step closer to helping to create the world's largest radio telescope — described as one of the biggest science projects in human history. Under the Convention, Western Australia will host more than 130,000 antennas and South Africa 200 dishes, allowing astronomers to view the cosmos in more detail than ever before.

The Australian component of the SKA, SKA-Low, is set to be the world's most sensitive low-frequency radio telescope. Hosted at CSIRO's Murchison Radio-astronomy Observatory and planned to move into the construction phase in mid-2021, the project is expected to generate hundreds of millions of dollars in economic activity for Australia over the next decade.

Australia is the fourth country to complete its national process of ratification, joining the Netherlands, Italy and South Africa. With the UK expected to complete its ratification in the coming weeks — the fifth and final country whose ratification is required — it is hoped the SKA Observatory will come into being before the end of the year.

And that's not the only piece of exciting astronomical news, with an international research team recently announcing the discovery of a rare molecule known as phosphine — which

consists of hydrogen and phosphorus — in the clouds of Venus. On Earth, this gas is only made industrially or by microbes that thrive in oxygen-free environments; its detection above Venus could thus point to extraterrestrial 'aerial' life.

The first detection of phosphine in the clouds of Venus was made using the James Clerk Maxwell Telescope (JCMT) in Hawaii — the largest single-dish astronomical telescope in the world designed specifically to operate in the submillimetre wavelength region of the electromagnetic spectrum. They confirmed their result using 45 telescopes of the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile, which saw the same thing — faint absorption at the right wavelength to be phosphine gas.

The researchers believe their find is significant because they can rule out many alternative ways to make phosphine, but they acknowledge that confirming the presence of 'life' needs a lot more work; for example, the high clouds of Venus are around 90% sulfuric acid, posing major issues for microbes to survive there. Still, their work points to the fact that there are still plenty of surprises out there waiting to be discovered, and not even a pandemic will stop the human race from making those discoveries.

Of course it would be remiss of me to ignore those breakthroughs that are a little more relevant to our lives back on Earth, which are as always highlighted in this very magazine. Flip to page 6 for tips on how to pick a new freezer for your lab or page 14 for the foods you should eat to lower your risk of stroke. Page 18 showcases how honeybee venom could be used to kill breast cancer and page 30 reveals the surprising hormone that's found in new fathers. And that's just the start!

So long, and thanks for all the fish.

Regards,  
Lauren Davis  
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At the time of writing Phase 3 clinical trials are underway for COVID-19 vaccines, some of which call for an ultralow-temperature freezer for storage and transport. Examples described in a September *Wall Street Journal* article note the unusually cold storage temperatures — as low as  $-80^{\circ}\text{C}$  — required. COVID-19 vaccine candidates are one of many applications for ultralow-temperature freezers.

Unlike 'ordinary' freezers, ultralow-temperature freezers are not inexpensive. But the investment is important when the job is to protect contents of high value and sometimes for long periods of time. Fortunately, there are a number of ultralow-temperature freezers on the market to ease the selection of a model that best suits your needs.

#### What is meant by ultralow-temperature freezers?

There are freezers, low-temperature freezers and ultralow-temperature (ULT) freezers on the market. Here are some examples that apply to scientific (not commercial or household) freezers. Note that different manufacturers may define the temperature capabilities of their various models differently.

- **Scientific laboratory and pharmacy freezers** can control ranges from  $-10$  to  $-25^{\circ}\text{C}$ .
  - **Low-temperature freezers**, depending on the model and function, can have a minimum of  $-25$ ,  $-35$  or  $-40^{\circ}\text{C}$ , also with a user-controlled range.
  - **Ultralow-temperature freezers** control temperatures down to  $-86^{\circ}\text{C}$ , also with precise temperature control.
- But remember...

#### Colder is not always better

Base your decision on the recommended storage temperature for what you put in your freezer. Our

# When and how to specify an ultralow-temperature freezer





ULT freezers may house multiple and different experiments, some of which may require frequent checking while others remain undisturbed for lengthy periods of time.

next section provides some examples. Just as with your room or central air conditioner, a colder setting means a higher power consumption.

Keep in mind as well that when you access the unit you allow ambient-temperature air to enter. We'll get into that later.

#### Typical applications

ULT freezers find wide application for biological and biotech storage applications in:

- most recently — potential COVID-19 vaccine storage
- research universities
- medical centres and hospitals
- blood banks
- forensic labs for long-term evidence storage
- establishing performance specs for parts used in extreme environments

In addition to COVID-19 vaccine candidates, other examples require ULT freezers to store biological samples such as DNA/RNA, plant samples and insect artefacts, autopsy materials, blood, plasma and tissues, chemicals, drugs and antibiotics.

Manufacturing firms and performance testing labs use ULT freezers to determine the ability of products and machinery to perform reliably under severe low-temperature conditions such as found in Arctic and Antarctic regions.

These myriad applications suggest that ULT freezers may house multiple and different experiments, some of which may require frequent checking while others remain undisturbed for lengthy periods of time.

And in fact if they do, this becomes a feature that can be applied to your selection process.

#### What to look for in a ULT freezer

##### 1. Temperature control

As suggested above, the lower you set the thermostat on a ULT freezer (or any freezer

for that matter) the more energy it consumes to maintain that temperature. So again, it is a smart idea to match the temperature capability to storage or environmental testing recommendations. The key is a precisely adjustable thermostat.

For example, Nor-Lake Ultra-Low upright and chest freezers offered by Tovatech allow temperatures to be adjusted and displayed in 0.1°C increments while onboard systems and maintenance diagnostics ensure optimal freezer performance.

You'll decide how important such a degree (no pun intended) of temperature control is to your requirements. But we suggest you look for models that display your set and actual internal temperature. This can alert you to a potential malfunction in the unit.

##### 2. Temperature excursion alarming

High-efficiency insulation plus cabinet- and door-mounted gaskets contribute to energy-efficient performance. But things can go wrong, in which case an alarming system should provide an immediate alert, and it should be functional in a power outage.

Look for a battery-operated system with an audio and visual alert (and optional remote alerts) that activate if the temperature increases above the set value. Personnel should be able to test the alarm system. A low-battery indicator is a useful feature.

##### 3. Record keeping

Accurate record keeping when storing valuable and/or temperature-sensitive products is critical. It is one of the key requirements, for example, in the CDC's 2020 Vaccine Storage and Handling Toolkit.

##### 4. Isolating specimens

When you open a freezer door, you provide access for ambient temperature air. This makes it advisable to select a ULT freezer with separate internal compartments.



Equipment available from Tovatech, for example, has not only a main door but also interior compartments with individual insulated magnetic catch doors. This confines the intrusion of ambient air to the accessed compartment.

Compartments can be fitted with optional individual specimen racks to hold separate containers that in turn can accommodate cell dividers. Labelling compartment doors, specimen racks and individual containers speeds content removal and return, further enhancing operating efficiency.

### Selecting your ULT freezer size

How much storage capacity do you really need? All freezers operate more efficiently when they are full. This is because the contents help stabilise holding temperatures.

The criteria for size should also take into account space available (ie, footprint). In brief, interior volumes can range from 370 to 850 L for upright models and 56 to 765 L for chest models.

### Other considerations

The Nor-Lake Scientific Select ULT freezer design was beta-tested in a large clinical lab where scientists and technicians commented on several noteworthy features. If your organisation is considering a ULT freezer you'll probably be comparing the offerings of several manufacturers, and may be interested in what the beta test revealed:

- Sturdy construction — specifically, door handles/latches that will stand up to years of rugged use.
- Fast temperature recovery after door opening, reducing incidents of triggering the alarm during daily use.
- A front-mounted eye-level control system that displays a real-time clock, event logging, alarm history, advanced alarms, alarm test and memory functions.
- An interior design that readily accepts rack systems and storage containers from other models.

These and other features are among the reasons why this lab decided to move everyday samples to the Nor-Lake ULT freezer design, using their older units for non-routine sample storage.

Other useful features include:

- Onboard system and maintenance diagnostics to reduce guesswork.
- Multibulb gaskets on doors and cabinets for temperature stability.
- Separate internal storage compartments with insulated doors and internal adjustable shelving to minimise content exposure to ambient air.
- CFC-free foam insulation that contributes to structural strength, as opposed to vacuum panels that can leak and can suffer damage during transport and/or repositioning.

- High ratio of internal space to external dimensions.
- Useful options including temperature chart recorders, phone dialers, LN<sub>2</sub> and CO<sub>2</sub> backup.

### To wrap things up

An ultralow-temperature scientific freezer represents a substantial investment. Arm yourself with facts about your particular application, then contact the freezer professionals at Tovatech for advice on selecting a ULT freezer that best meets your requirements.

*\*Before co-founding Tovatech, Rachel Kohn worked in business development and project management at Smiths Detection, Photon-X, Cardinal Health and Hoechst Celanese. Before that he spent 12 years as an R&D chemist at Hoechst Celanese and Aventis working on advanced drug delivery systems, polymer films and membranes, optical disks and polysaccharides. Tovatech is a leading supplier of ultrasonic cleaners and other lab or small business equipment.*

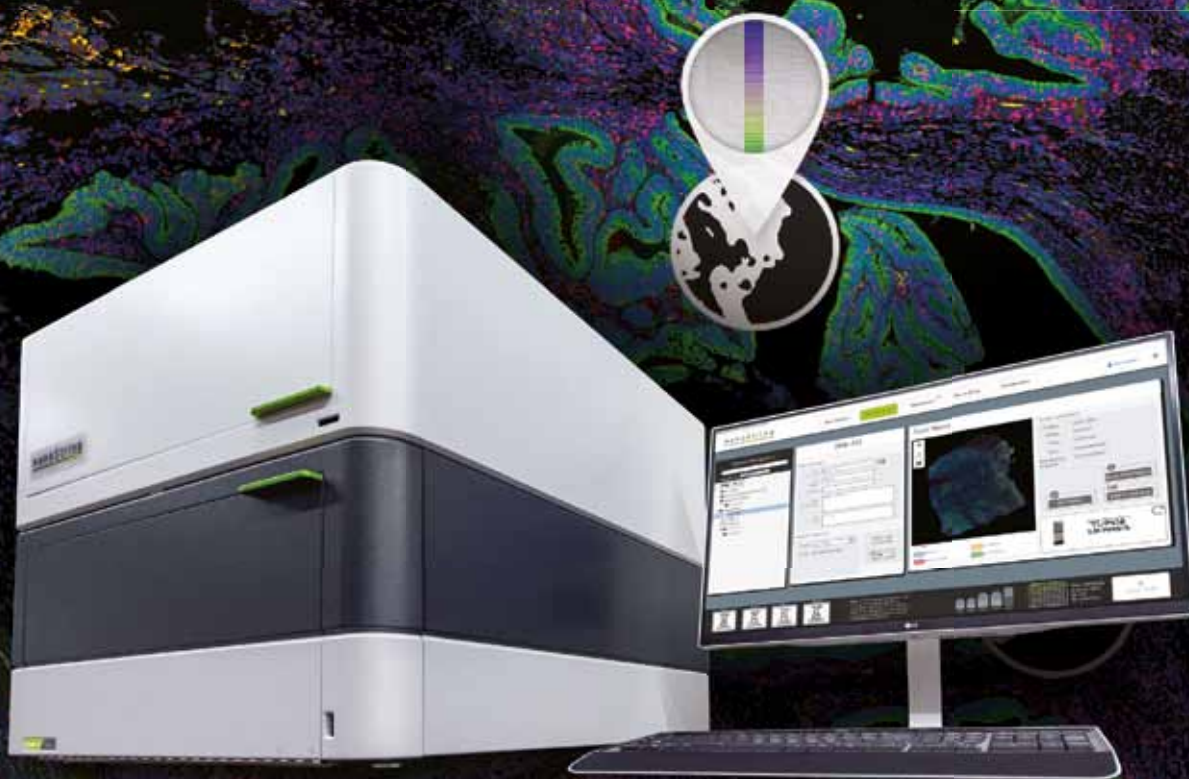
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## Health warning for high-heat red meat

Culinary experts recommend high-heat caramelisation to boost the flavour of meat, but the results from a recent study suggest that this could be bad for our health.

The University of South Australia (UniSA) study — conducted in partnership with Gyeongsang National University — found that consuming red and processed meat increased a protein compound that may increase the risk of heart disease, stroke and complications in diabetes. UniSA researcher Dr Permal Deo said the research, published in the journal *Nutrients*, provides important dietary insights for people at risk of such degenerative diseases.

“When red meat is seared at high temperatures, such as grilling, roasting or frying, it creates compounds called advanced glycation end products — or AGEs — which, when consumed, can accumulate in your body and interfere with normal cell functions,” Dr Deo explained.

“Consumption of high-AGE foods can increase our total daily AGE intake by 25%, with higher levels contributing to vascular and myocardial stiffening, inflammation and oxidative stress — all signs of degenerative disease.”

The study tested two diets: one high in red meat and processed grains; the other high in whole grains, dairy, nuts, legumes and white meat using steaming, boiling, stewing and poaching cooking methods. The diet high in red meat significantly increased AGE levels in blood, suggesting it may contribute to disease progression.

UniSA co-researcher Professor Peter Clifton said while there are still questions about how dietary AGEs are linked to chronic disease, the research shows that eating red meat will alter AGE levels.

“The message is pretty clear: if we want to reduce heart disease risk, we need to cut back on how much red meat we eat or be more considered about how we cook it.

“Frying, grilling and searing may be the preferred cooking methods of top chefs, but this might not be the best choice for people looking to cut their risk of disease.

“If you want to reduce your risk of excess AGEs, then slow-cooked meals could be a better option for long-term health.”

## AI platform predicts clinical trial outcomes

Predictive analytics company Opyl has developed software that uses artificial intelligence (AI) to predict the probability of a vaccine, drug, diagnostic or medical device succeeding in clinical trials. The aim of the software platform is to work with drug and device development companies to refine their clinical trial approaches to improve the outcomes of their clinical studies, reducing costs and accelerating the timeline to get new treatments to patients.

The AI platform uses current and historical global data and considers factors including the numbers of participants in each trial; the dropout rate from those trials; how long each trial will take; the end point for each trial relative to related studies; and the mode of action, such as type of protein or vector being employed in a program. The platform has already delivered early results that are claimed to be more accurate than previously published models and with more functional features, including the potential to optimise trial design.

“Our approach is to use AI to not just predict the outcome, but to demonstrate that changing specific clinical trials variables can improve the probability of success,” said Opyl CEO Michelle Gallaher.

To illustrate a proof of concept, the company applied the platform to 475 clinical trials for vaccines and therapies targeting COVID-19. The results were as follows:

1. Therapies show a much higher probability of success in clinical studies than vaccines.
2. To date Opyl has identified the two vaccines most likely to succeed their current stage of development (phase) compared to all others.
3. Antibody therapies have the best probability of success of getting a positive phase 3 outcome over all other programs.

The next stage of the platform’s development will involve increasing the data pool from additional clinical data sources and expanding the variables in order to further train the algorithm and refine the specificity and reliability.

“Although looking at the current pipeline of COVID-19 programs is an initial application of the AI platform, we are not limiting ourselves to just COVID-19 trials,” Gallaher stated. “The AI platform can be applied to all drugs, diagnostics, vaccines and medical devices about to begin or in clinical trials, and our goal is to improve the clinical trial process, which will in turn save money, time and ensure patients can access treatment options sooner.”

Opyl is now reaching out to those groups that may have an interest in the findings from the COVID-19 work, as well as continuing discussions with companies and partners on other applications of the technology.





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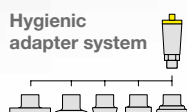
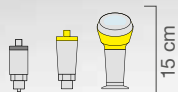


## 256 colours

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- Measurement in progress
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- Process malfunction

### Compact design



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VEGABAR 39 Clamp 1"



## TGA approves gene therapy to treat retinal disease

The Therapeutic Goods Administration (TGA) has registered Novartis's LUXTURNa (voretigene neparvovec), the first gene therapy in Australia, for the treatment of patients with inherited retinal dystrophy caused by pathological biallelic RPE65 mutations and who have sufficient viable retinal cells as determined by the treating physician.

Children and adults born with a mutation in both copies of the RPE65 gene can suffer from a range of symptoms, including night blindness (nyctalopia), loss of light sensitivity, loss of peripheral vision and loss of sharpness or clarity of vision. Many patients born with a mutation in both copies of the RPE65 gene will go blind by the time they are 16, with the majority progressing to total blindness by their mid-thirties.

LUXTURNa is designed to be injected under the retina and carries a functioning RPE65 gene to replace the faulty one. By providing a working copy of the gene, LUXTURNa has the potential to restore vision and improve sight with a sustained effect. The TGA's decision to register the therapy is based on data from a Phase 1 clinical trial, its follow-up trial and the first randomised, controlled Phase 3 gene therapy trial for an inherited disease.

In the Phase 3 clinical trial, vision improvement was recorded as early as 30 days after treatment. At one year, compared with the control group, patients treated with LUXTURNa improved by 1.6 light levels on the binocular multi-luminance mobility test (MLMT), the trial's novel, patient-centric, primary endpoint. Vision improved by one or more light levels for 90% of patients treated with LUXTURNa, and 65% were able to successfully navigate the MLMT at the lowest light level of 1 lux at one year.

"LUXTURNa is the first gene replacement therapy for blinding eye conditions and one of the first gene replacements for any human disease," said Professor John Grigg from the Save Sight Institute, The University of Sydney.

"This heralds a new era in transforming the lives of these people who otherwise have a life of blindness ahead of them. Although this treatment is for a rare genetic form of retinal dystrophy, this therapy will be the first of many providing hope and treatment for many people."

"This is groundbreaking news in Australia; the first eye gene therapy soon to be available for clinical use," added Professor Robyn Jamieson from the Children's Medical Research Institute and The University of Sydney.

"It is a revolutionary change for people with genetic retinal disorders like retinitis pigmentosa, because it provides real hope for therapies for this whole group of conditions."

## Smart magnetic stirrer 'speaks' to lab equipment

A current problem for chemists is that, when stirring a solution in the laboratory, there is a need to check the properties of the solution and monitor how they change. Seeking to solve this problem, researchers from the University of Warwick developed the Smart Stirrer — a magnetic stirrer bar with an integrated process monitoring system.

As described in the journal *ACS Sensors*, the Smart Stirrer performs the function of a conventional laboratory stir bar but also features an integrated microprocessor and various sensors capable of reporting the conversion of properties of a solution. The sensor stir bar is a capsule-shaped magnet encased in plastic.

A beaker filled with a solution is placed on a platform that generates a rotating magnetic field; when the magnetic stirrer is placed in the solution, it continuously rotates stirring the liquid. The Smart Stirrer then monitors attributes including colour, transparency, conductivity, viscosity and temperature. The results are sent to a computer over Bluetooth, and any changes notify the user wirelessly.

The concept is valuable to research and design laboratories, as well as pharmaceutical and chemistry manufacturing industries, because it allows wireless monitoring of several parameters of a chemical reaction simultaneously. As noted by Dr Dmitry Isakov from the Warwick Manufacturing Group (WMG), "The beauty of the Smart Stirrer is that it can be used everywhere, such as a sealed vessel, thus minimising the contamination of the reactor. It may give a push to new discoveries as well. It is easy to integrate the stirrer into the labware family and make it 'speak' to other lab equipment.

"We are still continuing research into the stirrer; the next revision of the stirrer sensor will be smaller [in] size and with more sophisticated sensors. We are collaborating with several chemists from Warwick University. This will help us to understand their needs and help to improve the device."

The University of Warwick's Samuel Baldwin added, "We have leveraged state-of-the-art technology to build a device with very low power consumption, a broad range of sensor capabilities and high data throughput over the Bluetooth Low Energy platform.

"The laboratory of the future is that of automation, reproducibility and safety; our all-in-one Smart Stirrer device eliminates the need for a vast array of individual wired sensors whilst maintaining the control and customisability that one would expect from any piece of advanced laboratory equipment. I look forward to seeing the Smart Stirrer solve laboratory problems and help us understand complex reactions."



Demonstration of how the Smart Stirrer works. Image credit: WMG, University of Warwick.





# iMScope QT

## IMAGING MASS MICROSCOPE

Inheriting the concept of a mass spectrometer equipped with an optical microscope from the iMScope series, the iMScope QT is Shimadzu's flagship model for MS imaging with a Q-TOF MS.

### Combined Analysis

Fusion of MS images with optical microscope observations.

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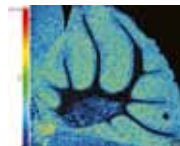
Obtain qualitative and quantitative information from LC-MS as well as position information from mass spectrometry imaging with a single instrument.

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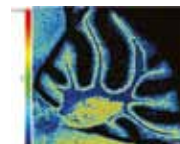
Optical microscope image



m/z 885.55



m/z 888.57



m/z 888.63





Different types of food are linked to risks of different types of stroke, according to a study published in the *European Heart Journal*. The study authors say the associations they found between different foods and different strokes might be explained partly by the effects on blood pressure and cholesterol.

**S**troke is the second-leading cause of deaths worldwide, and comes in two different forms. Ischaemic stroke occurs when a blood clot blocks an artery supplying blood to the brain or forms somewhere else in the body and travels to the brain where it blocks blood flow, whereas haemorrhagic stroke occurs when there is bleeding in the brain that damages nearby cells. About 85% of strokes are ischaemic and 15% are haemorrhagic.

Until now, most studies have looked at the association between food and total stroke (all types of stroke combined), or focused on ischaemic stroke only. The European Prospective Investigation into Cancer and Nutrition (EPIC) study of more than 418,000 people in nine European countries, conducted between 1992 and 2000, investigated ischaemic stroke and haemorrhagic stroke separately.

The total amount of fibre (including fibre from fruit, vegetables, cereal, legumes, nuts and seeds) that people ate was associated with the greatest potential reduction in the risk of ischaemic stroke. Every 10 g more intake of fibre a day was associated with a 23% lower risk, which is equivalent to around two fewer cases per 1000 of the population over 10 years. The European Society of Cardiology (ESC) suggests people should consume 30–45 g of fibre a day, with good sources including wholemeal toast (6.6 g for two thick slices), broccoli (3 g for eight florets) and apples (1.2 g for one raw, unpeeled fruit).

Fruit and vegetables alone were associated with a 13% lower risk of ischaemic stroke for every 200 g eaten a day, which is equivalent to one less case per 1000 of the population over 10 years. The ESC and the World Health Organization Regional Office for Europe recommend consuming at least 400 g of fruit and vegetables a day.

But while higher intakes of fruit, vegetables, fibre, milk, cheese or yoghurt were each linked to a lower risk of ischaemic stroke, there was no significant association with a lower risk

of haemorrhagic stroke. Meanwhile, greater consumption of eggs was associated with a higher risk of haemorrhagic stroke; for every 20 g of eggs consumed a day, there was a 25% higher risk of haemorrhagic stroke, or 0.66 extra cases per 1000 of the population over 10 years. A typical large-sized egg weighs approximately 60 g.

“The most important finding is that higher consumption of both dietary fibre and fruit and vegetables was strongly associated with lower risks of ischaemic stroke, which supports current European guidelines,” said first author Dr Tammy Tong, from the University of Oxford. “The general public should be recommended to increase their fibre and fruit and vegetable consumption, if they are not already meeting these guidelines.

“Our study also highlights the importance of examining stroke subtypes separately, as the dietary associations differ for ischaemic and haemorrhagic stroke, and is consistent with other evidence, which shows that other risk factors, such as cholesterol levels or obesity, also influence the two stroke subtypes differently.”



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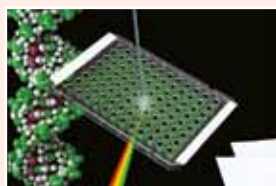
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# The nbn is coming — is your lab ready?





As the national broadband network (nbn) is rolled out, it brings the promise of enhanced productivity, reliability and digital integrations with it. But not every IT system in the laboratory is designed for smooth integration with the nbn, and systems that rely on analog phone lines and Voice over Internet Protocol (VoIP), like fax machines and fax servers, will struggle to keep up.

Once each area has been announced for changeover to the nbn, you'll generally have 18 months to switch over to the new network, depending on your provider. After your area has switched to the nbn, the Telstra supplied copper and cable broadband networks will be disconnected.

### Why faxing is still critical to medical research

Faxing documents securely over the phone line was once seen as cutting-edge technology that allowed documents to be sent quickly and securely anywhere in the world that had a fax number.

Over time, the traditional fax machine systems have been integrated from stand-alone machines to being part of multi-function printers (MFP) and the creation of dedicated fax servers to manage the wealth of data being sent. Within the healthcare and medical research sector there's still a critical need for faxing documents, especially when privacy laws and security concerns restrict the use of email servers and popular storage programs such as GDrive and Dropbox. When emails became more widely used in business, they quickly presented security concerns, and many industries still restrict sending unencrypted data via email.

### A mishmash of systems leads to chaos and disruption

Legacy fax machines are erratic at the best of times — paper jams, dropped signals and server errors cause daily frustrations for laboratories. Patient deaths both in Australia and overseas have been attributed to the unreliability of faxes, where critical information was sent to the wrong number, wrong department or simply overlooked in busy hospital departments that share a fax machine and printer.

In the current environment, the reliance on manual fax machines has created chaos for laboratories as they struggle to cope with the unprecedented influx of faxes and trying to mix old and new data systems.

With a volume of testing results being faxed simultaneously, there are inevitable delays

in processing, pages getting lost or missing in transmission, results being mixed up for different patients, and a wealth of data piling up on fax machines that needs to be processed and reported urgently.

The huge volumes of results and requests being faxed through also means that urgent requests, such as those for healthcare and aged-care workers, may be overlooked. Sending and receiving confidential health data via fax may be secure from cyber threats, but opens up risks and delays while it's then printed, manually entered into systems or hand delivered within facilities for actioning.

### How will traditional faxing be affected by the nbn?

With the nbn rollout, the future of legacy faxing systems isn't bright. Existing analog phone lines will be disconnected, causing issues for fax machines that rely on these lines. Dedicated phone/fax numbers (and the associated costs) will be required to send and receive faxes. With the increasing volume of data being sent via fax, VoIP systems will struggle to keep up and ICT teams will need to implement a mix of old and new technology with workarounds as they struggle to keep up. And with the average fax machine and MFP having a shelf life of five years, along with the cost of set-up, maintenance and consumables, the cost and complexity of maintaining a traditional fax machine will continue to mount up.

### There's a brighter future for faxing

The rollout of the nbn is opening up opportunities to look at faxing in new ways — how can we send, receive, store and share documents securely and instantly without a fax machine?

Cloud-based faxing is a system that allows users to send and receive faxes on their existing fax number, but the faxes are stored online. Users are able to log in to the system and access, download, sign, share and send faxes securely.

A fax can be sent at the touch of a button to a physical fax machine, email, personal device, phone or computer, with just a few clicks.

Because cloud faxing is online, users can send and receive multiple faxes at once, and each fax is automatically logged and traced with opens and downloads, making auditing and compliance a breeze. No matter whether you're working in the lab or from home, you can reliably send, receive, sign and share faxes without needing a physical fax machine.

### Tips for getting ready for the nbn

- Know when the nbn is coming to your area.
- Prepare early and find out whether you need to change landline and internet services.
- Shop around for the best provider for your needs.
- Get ready to switch over.
- Switch early to eFax to avoid any issues.
- Consider what equipment you may need to upgrade/switch.
- Do a cost analysis of different options to evaluate your needs.

### Can you rely on your current fax machine to see your laboratory through?

More than ever before, we're seeing rapid and massive disruptions to the way we work and manage our workloads. As ICT teams grapple with complex privacy and document control requirements and try to integrate multiple systems and processes into the existing systems, it's easy to see how cloud faxing is a logical solution to streamlining data processing within the medical testing environment. With reliability and compliance built into the systems, cloud faxing frees up ICT teams from the installation, maintenance and ongoing system upgrades that legacy faxing systems demand.

eFax  
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# Honeybee venom kills aggressive breast cancer cells

Venom from honeybees has been found to induce cancer cell death in hard-to-treat triple-negative breast cancer, with minimal effect on healthy cells. The discovery was made by Dr Ciara Duffy as part of her PhD and has been published in the journal *Nature Precision Oncology*.

**D**r Duffy wanted to investigate the anticancer properties of honeybee venom and a component compound, melittin, on different types of breast cancer cells — including triple-negative breast cancer, which has limited treatment options. Overseen by Associate Professor Pilar Blancafort at the Harry Perkins Institute of Medical Research, and with the assistance of 312 honeybees and bumblebees, she quickly got to work.

Dr Duffy began by collecting Perth honeybee venom, with the knowledge that Perth bees are some of the healthiest in the world. She would go on to compare the effects of the venom to that of other honeybee populations in Ireland and England, as well as to bumblebees.

“The bees were put to sleep with carbon dioxide and kept on ice before the venom barb was pulled out from the abdomen of the bee and the venom extracted by careful dissection,” Dr Duffy said.

“We tested honeybee venom on normal breast cells and cells from the clinical subtypes of breast cancer: hormone receptor positive, HER2-enriched and triple-negative breast cancer,” she said.

“We [also] tested a very small, positively charged peptide in honeybee venom called melittin, which we could reproduce synthetically, and found that the synthetic product mirrored

the majority of the anticancer effects of honeybee venom.

“We found both honeybee venom and melittin significantly, selectively and rapidly reduced the viability of triple-negative breast cancer and HER2-enriched breast cancer cells.”

Dr Duffy described the honeybee venom as “extremely potent”, with a specific concentration of the venom found to induce 100% cancer cell death while having minimal effects on normal cells.

“I found that the European honeybee in Australia, Ireland and England produced almost identical effects in breast cancer compared to normal cells,” Dr Duffy said. “However, bumblebee venom was unable to induce cell death even at very high concentrations.”

Meanwhile, melittin was found to completely destroy cancer cell membranes within 60 minutes. The compound also had another remarkable effect — within 20 minutes, it was able to substantially reduce the chemical messages of cancer cells that are essential to cancer cell growth and cell division.

“We looked at how honeybee venom and melittin affect the cancer signalling pathways — the chemical messages that are fundamental for cancer cell growth and reproduction — and we found that very quickly these signalling pathways were shut down,” Dr Duffy said.

“Melittin modulated the signalling in breast cancer cells by suppressing the activation of the receptor that is commonly overexpressed in

triple-negative breast cancer, the epidermal growth factor receptor, and it suppressed the activation of HER2, which is over-expressed in HER2-enriched breast cancer.”

Western Australia’s Chief Scientist, Professor Peter Klinken, said, “This is an incredibly exciting observation that melittin, a major component of honeybee venom, can suppress the growth of deadly breast cancer cells, particularly triple-negative breast cancer.

“Significantly, this study demonstrates how melittin interferes with signalling pathways within breast cancer cells to reduce cell replication. It provides another wonderful example of where compounds in nature can be used to treat human diseases.”

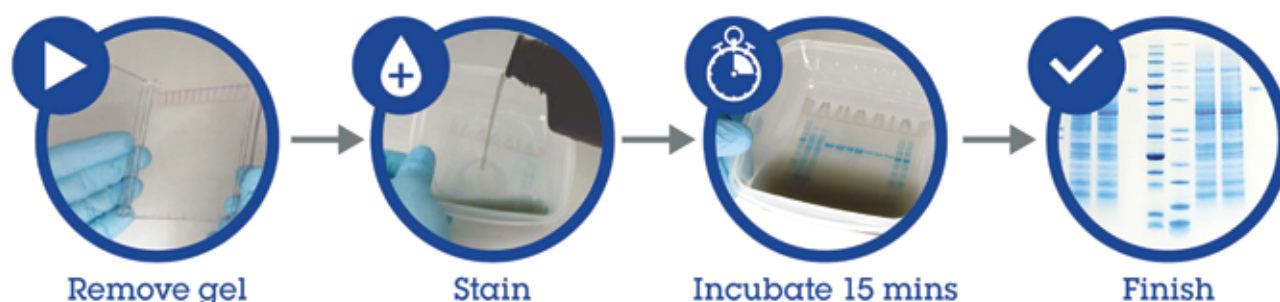
Dr Duffy also tested to see if melittin could be used with existing chemotherapy drugs as it forms pores, or holes, in breast cancer cell membranes, potentially enabling the entry of other treatments into the cancer cell to enhance cell death.

“We found that melittin can be used with small molecules or chemotherapies, such as docetaxel, to treat highly aggressive types of breast cancer,” she said. “The combination of melittin and docetaxel was extremely efficient in reducing tumour growth in mice.”

In the future, studies will be required to formally assess the optimum method of delivery of melittin, as well as toxicities and maximum tolerated doses.



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## Microbiology lab goes digital



Bangkok's Bumrungrad International Hospital has used InterSystems' TrakCare Lab Enterprise — said to be the only business management system for clinical labs — to create what has been described as one of the first fully digital microbiology laboratories in the world.

Currently, very few microbiology labs have fully digitised their operations. This is partly because of the complexity of their workflows, and also due to a lack of electronic medical record (EMR) systems that support either end-to-end lab processes or integrated workflows across the best-of-breed systems used in microbiology labs. Having deployed InterSystems' TrakCare unified healthcare information system in October 2018 to support care delivery throughout the hospital — including the digitisation of Bumrungrad's core laboratory handling 60–70% of the hospital's five million annual sample tests — Bumrungrad partnered again with InterSystems to digitise the end-to-end processes of its microbiology lab.

As a core function, microbiology labs culture and identify microbes and test their susceptibility to antibiotics to establish the best treatments for patients. They follow an investigative process with each step dependent on the results of the previous step. Bumrungrad, for example, identifies up to three organisms per sample and tests multiple antibiotics against each.

To digitise this process, Bumrungrad created a decision tree to map its microbiology workflows and TrakCare Lab Enterprise was configured to support them. Unlike traditional lab data and analytical management solutions, TrakCare Lab Enterprise integrates patient data within the EMR for improved clinical support and patient-centred workflows, has built-in integration capabilities

for interoperability with other systems and captures comprehensive operational data for better lab decision-making.

The product's interoperability capabilities were also used to integrate with the BD EpiCenter microbial identification and VITEK antibiotic susceptibility systems via standard HL7 messaging. TrakCare Lab Enterprise now digitally manages the entire end-to-end testing process and, with no product customisation needed, the configuration will continue to work with future, enhanced versions of TrakCare.

The benefits of this digital transformation include improved service delivery, increased patient safety, reduced turnaround times and enabling the optimisation of robotics and automation. For example:

- Clinicians at Bumrungrad can place microbiology orders in TrakCare and receive results within a patient's EMR, improving turnaround times and ease of use.
- Reports delivered in a structured data format — rather than a PDF scan — enable clinicians to analyse results in context and make full use of decision support systems.
- Patient safety is protected by eliminating manual transcription errors and validating sample and cultured materials using system-generated barcodes. This ensures that the right test is performed on the right patient with the right result.

"Our clinicians are very happy with the digital transformation of microbiology," said Jeremy Ford, Laboratory Research and Technology Director for Bumrungrad. "The primary outcome is improved service delivery — making it easier for clinicians to deliver care, having confidence in the results with no transcription errors and reporting results in a much more timely way."





"Longer term, the transformation will have a profound impact. It enables accurate, real-time reporting for infection control, for example, which is very important for both patient safety and government reporting. It can take hospitals weeks to compile infection control reports using spreadsheets. In TrakCare, with digitised processes and an integrated EMR, you can run an infection control report every day."

Bumrungrad will roll out further enhancements to TrakCare Lab Enterprise in its surgical pathology and referral laboratories later this year, with the blood bank following in early 2021, making all lab processes fully digital and paperless. Ford noted, "Each of the departments needs to be digital to allow high-throughput robotics and automation. It is no good investing in complex robotics if you have paper flowing around and you cannot digitally optimise its use."

"We are excited to be working with Bumrungrad to fully support the digital transformation of their laboratories with TrakCare Lab Enterprise," said Martin Wilkinson, Product Director, Laboratories for InterSystems. "Clinical labs face growing demands for faster, more reliable, more accountable and more comprehensive processing and reporting of results. Where they could once rely on manual methods, labs like Bumrungrad's are adopting automated methods of plating, identification and susceptibility testing to meet those demands — and increasingly require digital technology platforms to drive that transformation."

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## RNase inhibitor

PCR Biosystems' RiboShield RNase Inhibitor, already an important component of several of the company's kits, is now available as a standalone product. It is a recombinant protein, purified from a strain of *Pichia pastoris* that expresses a modified human placental gene, and blocks the activity of a wide range of ribonucleases to protect RNA from RNase digestion.

The inhibitor is designed for use in a variety of RNA-sensitive applications, including RNA purification, cDNA synthesis, RT-PCR, RNA sequencing and in-situ hybridisation. With such techniques, the presence of even small amounts of RNase can be highly detrimental to RNA quality and experimental outcome. The product also complements PCR Biosystems' range of products to support COVID-19 research and testing.

One application for the inhibitor is in saliva-based testing for the presence of SARS-CoV-2. While the sample is simple to obtain, the digestive enzymes present in saliva make for a hostile environment for RNA. Using an RNase inhibitor is essential to provide adequate RNA protection and generate accurate test results.

The product performs over a wide variety of reaction conditions and can inhibit RNases at temperatures up to 65°C for at least 30 min. The molecule binds noncovalently at a ratio of 1:1 to inhibit the activity of a range of ribonucleases, including eukaryotic RNases of the neutral type (RNases A, B and C).

The inhibitor does not hinder other enzymes, such as reverse transcriptases, RNA polymerases or Taq DNA polymerase, making it compatible with many enzymatic reactions that utilise RNA. In addition, the rapid kinetics of association to RNases ensures immediate protection of RNA, leading to high performance in applications where RNase contamination is a concern.

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## Incapacitance tester for pain research

The Librae Incapacitance Tester by Ugo Basile has been designed to add speed and accuracy to weight distribution measurements in injured mice and rats. The device is used in osteoarthritis, bone cancer, nerve injury and post-operative pain research.

The device automatically records and compares differences in hind paw weight bearing for the assessment of spontaneous pain. Operator bias is thus reduced and trends can be monitored visually in real time.

The autostart feature identifies immobility windows, optimising test repeatability and saving operator time. The device is controlled quickly and seamlessly using a large colour touch screen.

Experiment data is displayed showing left/right weight and scatter charts and trend data. Recorded parameters include average paw weight, standard deviation, left/right ratio and more. Data is saved in universal .csv format for spreadsheets including Microsoft Excel.

The design is streamlined with no screws or protruding parts that could interfere with rodent comfort. Foot pads are easily removed and cleaned as they are conveniently attached magnetically. Quick calibration of high-quality force sensors (0.1 g resolution) is possible using the reference weight supplied.

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## Self-priming pump

Alfa Laval's LKH Prime 10 UltraPure is a compact self-priming pump that is suitable for duties up to 35 m³/h. It is primarily engineered for cleaning-in-place (CIP) return, but also transfers product in sterile processes. This is said to deliver savings of up to 50% in capital expenditures and installation, and 30% in annual operating expenses.

Other advantages include: up to 60% more energy savings than liquid ring pumps and up to 25% more than other airscrew pumps; a fully CIPable, EHEDG-certified hygienic design; low noise levels; easy maintenance and streamlined spare parts inventory due to the common LKH platform.

Alfa Laval UltraPure products are designed to boost pharma and biotech process efficiency, productivity and end-product quality, ensuring the responsible use of resources for sterile processing applications.

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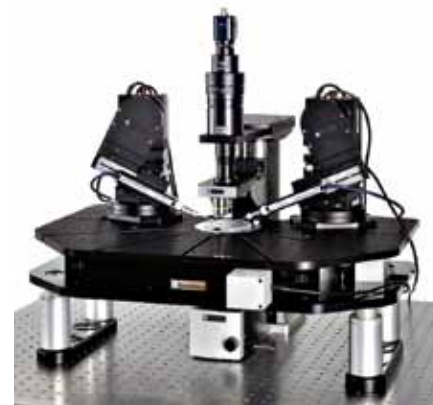
## Digital spatial profiler

NanoString's breakthrough spatial profiling technology, GeoMx, is designed to dig deep into protein and gene expression directly from mounted tissue sections. The technology lets the user select any particular cells under the microscope and quantify the protein or RNA molecules they express.

NanoString's strategy for counting individual molecules is now said to be more powerful than ever — quantify up to 96 different proteins or thousands of different RNA targets simultaneously from a tissue surface with digital precision. Furthermore, the technology is optimised for preserved FFPE samples as well as fresh frozen tissue.

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## Electrophysiology system

The SliceScope Pro 3000 electrophysiology system from Scientifica is a fixed microscope imaging system designed for in vitro electrophysiology and capable of accommodating advanced imaging, such as two-photon and confocal imaging. The system consists of a SliceScope, a motorised movable top plate, two micromanipulators (Patchstars or Microstars), two control devices (Patchpad, Control Cube or Joystick) and a sample plate and slice recording kit.

The motorised movable top plate offers a large mounting area with 25 mm of smooth motorised XY movement. Up to 50 memory positions can be stored via the control hardware, to enable swift return to identified interest areas. The platform, with incorporated mounting carriages, gives flexibility for positioning manipulators and other equipment. There are also options for fluorescent microscopy and a variety of contrast techniques. Move the platform beneath the fixed microscope while maintaining patches for easy access to the samples.

Benefits include a fixed platform for long-term imaging and electrophysiology, a slimline upright microscope and super-smooth Patchstar micromanipulators with 20 nm resolution for absolute positioning power. The product is suitable for network studies as users can add extra manipulators to the large top plate to enable recordings from more than two electrodes for complex neuronal studies. The focus, condenser, translation stage and micromanipulators can be controlled from any of the remote control options. Alternatively, Scientifica's LinLab software can be used to control all the company's motorised components and heating and perfusion elements.

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# Synthetic peptide takes away bacteria's drug resistance

Scientists at Nanyang Technological University, Singapore (NTU Singapore) have developed a synthetic peptide that can make multidrug-resistant bacteria sensitive to antibiotics again when used together with traditional antibiotics, offering hope for the prospect of a combination treatment strategy to tackle certain antibiotic-tolerant infections. The synthetic antimicrobial peptide can also kill bacteria that have grown resistant to antibiotics.

**A**ntibiotic resistance arises in bacteria when they can recognise and prevent drugs that would otherwise kill them from passing through their cell wall. This threat is accelerated by the developing COVID-19 pandemic, with patients admitted to hospitals often receiving antibiotics



to keep secondary bacterial infections in check, amplifying the opportunity for resistant pathogens to emerge and spread.

“While efforts are focused on dealing with the COVID-19 pandemic, we should also remember that antibiotic resistance continues to be a growing problem, where secondary bacterial infections that develop in patients could complicate matters, posing a threat in the healthcare settings,” said Professor Mary Chan, Director of NTU’s Centre of Antimicrobial Bioengineering. “For instance, viral respiratory infections could allow bacteria to enter the lungs more easily, leading to bacterial pneumonia, which is commonly associated with COVID-19.”

Antimicrobial peptides, which carry a positive electric charge, typically work by binding to the negatively charged bacterial membranes, disrupting the membrane and causing the bacteria to die eventually. The more positively charged a peptide is, the more efficient it is in binding to bacteria and thus killing them. However, the peptide’s toxicity to the host also increases in line with the peptide’s positive charge — it damages the host organism’s cells as it kills bacteria. As a result, engineered antimicrobial peptides to date have met with limited success.

The NTU Singapore team, led by Prof Chan and Associate Professor Kimberly Kline, developed an antimicrobial peptide known as CSM5-K5 comprising repeated units of chitosan — a sugar found in crustacean shells that bears structural resemblance to the bacterial cell wall — and repeated units of the amino acid lysine. The

scientists believe that chitosan’s structural similarity to the bacterial cell wall helps the peptide interact with and embed itself in it, causing defects in the wall and membrane that eventually kill the bacteria.

CSM5-K5 is able to cluster together to form nanoparticles when it is applied to bacteria biofilms, which can cling onto surfaces (including living tissues) and are difficult for traditional antibiotics to penetrate. This clustering results in a more concentrated disruptive effect on the bacterial cell wall when compared to the activity of single chains of peptides, meaning it has high antibacterial activity but without causing undue damage to healthy cells.

To examine CSM5-K5’s efficacy on its own, the scientists developed separate biofilms comprising methicillin-resistant *Staphylococcus aureus* (MRSA), a highly virulent multidrug-resistant strain of *Escherichia coli* (MDRE *E. coli*) and vancomycin-resistant *Enterococcus faecalis* (VRE), the latter two of which are classified as serious threats by the US Centers for Disease Control and Prevention. In lab experiments, CSM5-K5 killed more than 99% of the biofilm bacteria after four hours of treatment; in infected wounds on mice, the peptide killed more than 90% of the bacteria.

When CSM5-K5 was used with conventional antibiotics, the NTU team found that the combination approach led to a further reduction in the bacteria in both lab-formed biofilms and infected wounds in mice as compared to when only CSM5-K5 was used, suggesting that the antimicrobial peptide made the bacteria sensitive to the drugs they would otherwise be resistant

to. The team also found that the three strains of bacteria studied developed little to no resistance against CSM5-K5 and, while MRSA developed low-level resistance against CSM5-K5, this made MRSA more sensitive to the drug it is otherwise resistant to. The amount of antibiotics used in this combination therapy was also at a concentration lower than what is commonly prescribed.

“Our findings show that our antimicrobial peptide is effective whether used alone or in combination with conventional antibiotics to fight multidrug-resistant bacteria,” Assoc Prof Kline said. “Its potency increases when used with antibiotics, restoring the bacteria’s sensitivity to drugs again. More importantly, we found that the bacteria we tested developed little to no resistance against our peptide, making it an effective and feasible addition to antibiotics as a viable combination treatment strategy as the world grapples with rising antibiotic resistance.”

“Developing new drugs alone is no longer sufficient to fight difficult-to-treat bacterial infections, as bacteria continue to evolve and outsmart antibiotics,” Prof Chan added. “It is important to look at innovative ways to tackle difficult-to-treat bacterial infections associated with antibiotic resistance and biofilms, such as tackling the bacteria’s defence mechanisms. A more effective and economic method to fight bacteria is through a combination therapy approach like ours.”

The team’s findings have been published in the journal *ACS Infectious Diseases*. Their next step is to explore how a combination therapy approach can be used for rare diseases or for wound dressing.

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Equipped with a 2 MP CMOS sensor, the camera can display, capture and save full HD images of up to 1920 x 1080 pixels and display at 30 fps. Captured images and videos can be saved directly to an SD card which is inserted into the camera. Users can easily display scale bars, measure areas and calculate distances between two points.

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### Development platform for mRNA treatments and vaccines

Messenger RNA (mRNA) treatments are novel, disruptive technologies that offer a promising alternative to conventional therapeutic approaches given high potency, capacity for rapid development to full GMP and potential for low-cost manufacture. Unmodified and base-modified mRNA vaccines, such as the current approach by Moderna, encode the antigen of interest and untranslated regions, whereas self-amplifying mRNAs (SAM) are void of structural proteins (inherently safe) and encode not only the antigen but also the viral replication machinery that supports intracellular RNA amplification and abundant protein expression. This facilitates generous antigen production from an extremely small dose of vaccine.

RNA is susceptible to degradation in biological fluids. Lipid nanoparticles (LNP) are designed specifically to overcome the RNA delivery challenge. They co-opt endogenous uptake mechanisms to efficiently deliver RNA to cells in vitro and in vivo. GenVoy-ILM is a pre-optimised, easy-to-use lipid mixture designed to encapsulate RNA (mRNA, gRNA, siRNA, miRNA, tRNA) for delivery to cells.

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FastPrep-24 5G is a common choice and, coupled with all-metal sample holder, the instrument is suitable for work with highly infectious samples. The metal adapter can withstand temperatures up to 450°C, allowing for sterilisation by autoclaving. For high-throughput grinding, FastPrep-96 offers the widest variety of adapters (2 x 96 deep well plates, 96 x 2 mL, 48 x 4.5 mL, 24 x 15 mL, 8 x 50 mL and 2 x 250 mL flasks).

The use of the FastPrep instrument combined with FastDNA and RNA kits ensures an efficient lysis of the starting material and a simultaneous extraction of nucleic acid. The company's three latest kits include the SPINeasy DNA Kit for Soil, which features spin column technology and proprietary lysis buffers to protect DNA and remove humic substances; the MagBeads FastDNA Kit for Feces, using magnetic beads with high selectivity for gDNA, which suits both automated extraction instruments and manual extraction using a magnetic rack; and the FastRNA Win for Plant Kit, which employs mineral carrier particles to separate gDNA from RNA to purify high-quality total RNA and simultaneously inactivate endogenous RNases from plant cells and tissues.

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# 'Breastfeeding' hormone present in new dads

A major international study, published in the journal *Cell*, has found that new fathers are flooded with prolactin — the same chemical found in breastfeeding mothers.

**B**ut while in the mother the hormone activates lactation, in the father it unlocks the paternal instinct and helps to make him a better dad.

Raised levels of prolactin in the blood of new fathers have previously been observed in different species. In male human parents, it was found to rise both pre-birth and during parenting activities such as holding their child. But until now its presence had not been understood.

"Prolactin has historically been known for its role in lactation, but it's been a mystery why males even have this hormone," said study co-author Dr Kristina Smiley, from the University of Otago.

"We know it has some metabolic functions but we had no idea what role it played in reproduction for males."

Dr Smiley was part of an international team which attacked the problem from different angles. The study looked at prolactin function in two different species — rats and mice — where males exhibit contrasting behaviours around their young.

Male rats ignore their offspring, whereas male mice are actively involved in the care of their pups.

The two-year study found prolactin is regulated in completely different ways in these two animals, accounting for the behavioural differences. When researchers elevated prolactin levels in male rats, it triggered them to engage in paternal care such as grooming their pups. In contrast, when male mice had their prolactin blocked, they stopped taking care of their pups.

"It's a really dramatic change," Dr Smiley said. "The most significant parental behaviour that male mice exhibit is retrieving their pups to the nest to keep them warm and secure. But when we block this prolactin action, they don't pick them up at all. They just leave them outside of the nest."

"What this paper is showing is that if you get rid of the ability for the brain to respond to prolactin then males stop taking care of their young. You need prolactin in the brain for dads to be paternal."

Interestingly, raising prolactin in virgin males did not induce paternal behaviour, indicating that the hormone's effect on behaviour is conditional on prior sexual experience. The study also found that it was not just the level of prolactin but the way prolactin release is regulated by the brain that

also differed in these animals, contributing to the differences in paternal behaviours observed in rats and mice.

The results of the study may help investigations into postpartum mood disorders, which also affect men even though they don't experience pregnancy and childbirth. Dr Smiley explained, "When you look at depression, for example, a postpartum depressed patient and a major depressive patient will show the same outward symptoms. But the brain of a depressed patient looks completely different from a postpartum depression patient."

"It really comes back to how parental care is regulated and not so much how mood is regulated. There's something really special and unique that occurs in parents, specifically, that leads to these mood disorders. It seems to be more of a disruption in the brain areas that control parental behaviour, as opposed to these emotional centres."

The research team is now looking at how surges of prolactin might change the male's brain after mating to prepare them for fatherhood. Dr Smiley noted, "We know so much about maternal care and maternal behaviour, but we don't understand the paternal brain nearly as well."



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# Accurate solution phase affinity profiling of a SARS-CoV-2 antibody in serum

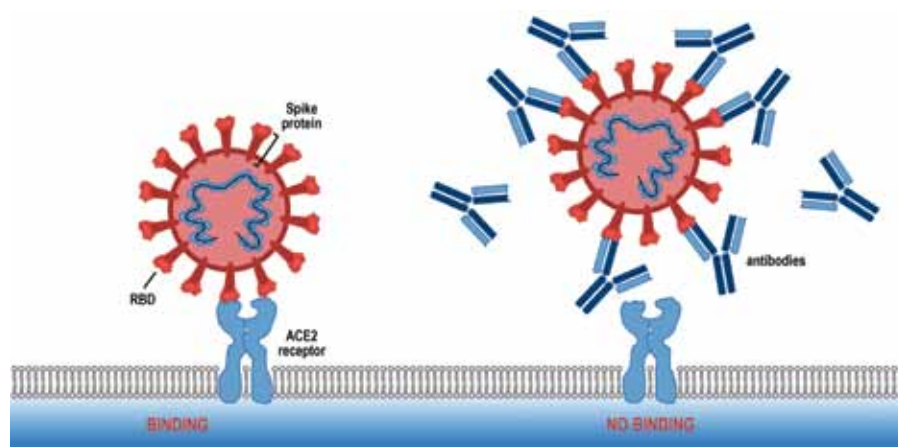
Viola Denninger, Sebastian Fiedler, Alison Ilsley, Heike Fiegler and Sean Devenish

The ability to accurately characterize the immune response against SARS-CoV-2 is of vital importance in managing the current COVID-19 pandemic.

Measuring antibody affinity under physiologically relevant conditions in complex mixtures like serum remains challenging but is critically important to furthering our understanding of the immune response and protection window in patients and vaccinated individuals. Using Microfluidic Diffusional Sizing (MDS), we have characterized an anti-spike S1 antibody by measuring its binding affinity to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein directly in serum.

## Introduction

In the quest to accurately identify individuals who are seropositive and effective vaccines against SARS-CoV-2, it is fundamental to thoroughly characterize the immune response during infection or after vaccination.



**Figure 1:** Antibodies that bind the RBD are expected to neutralize the SARS-CoV-2 virus. The RBD region of the spike S1 subunit binds to the ACE2 receptor on the cell membrane before the spike S2 subunit mediates membrane fusion. Binding of antibodies to the RBD can prevent receptor binding and subsequent invasion of the host cell.



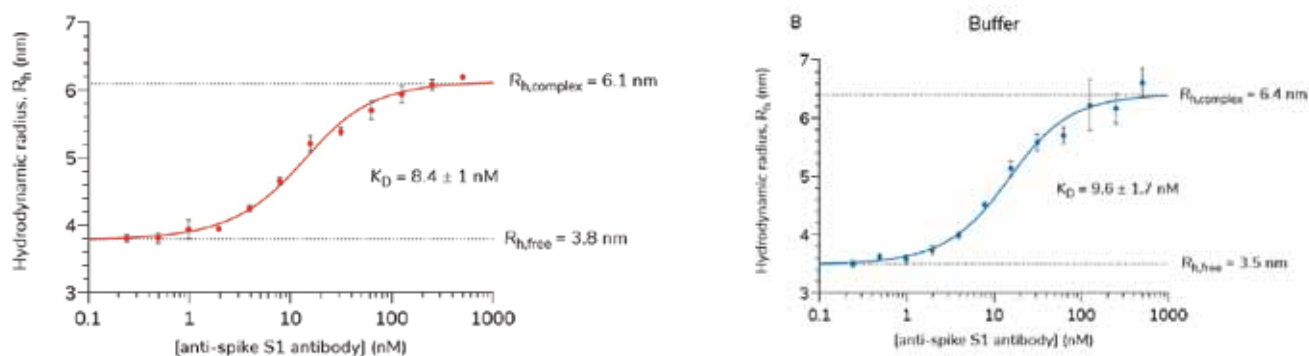


Figure 2: Equilibrium binding curves of anti-spike S1 antibody to 20 nM Alexa Fluor 647 labeled SARS-CoV-2 RBD in (A) buffer (PBS with 0.05% Tween 20) and (B) human serum. Measurements were performed in triplicate. For serum measurements, serum background fluorescence was subtracted from raw data before the KD was determined by non-linear least squares.

Specifically, the virus-neutralizing capacity of the immune system is of vital interest, and accurate tests to evaluate the affinity and quantity of neutralizing antibodies (NAbs) in serum samples of COVID-19 patients or vaccinated individuals are key.

For SARS-CoV-2 virions, the spike protein is crucial for virus entry into the host cell. It is composed of two subunits: S1, which binds to ACE2 (Figure 1); and S2, which mediates the entry of the virion into the cell. Due to its key role mediating the first step of viral invasion of host cells, the RBD (receptor binding domain) of S1 has proven to be the target of NAbs raised against other viruses of the corona family, and is likely to also be an important target in the case of SARS-CoV-2.<sup>1</sup>

In ELISA tests, which are used to determine seropositivity in patient samples, the reported titer for each sample is dependent on both concentration and affinity of the antibody. However, the contribution of each of these parameters to the detected signal cannot be accurately decoupled. The ability to determine these two important parameters independently is crucial for a deeper understanding of the immune response. This knowledge would therefore allow a better understanding of antibody maturation and persistence of immunity and could aid in convalescent plasma therapy research.

Measuring antibody affinity in human samples ideally makes use of undiluted serum to maximize the range of antibody concentrations that can be used to generate the equilibrium binding curve. Most established technologies for measuring protein binding, however, rely on surface immobilization of one of the binding partners. This can cause significant difficulties when working with complex samples such as serum due to non-specific binding of other proteins within the serum to the analytical

surface, leading to false positives or at least low signal-to-noise ratios.<sup>2,3</sup>

Here, we apply MDS to measure the affinity of an anti-spike S1 antibody to fluorescently labeled SARS-CoV-2 RBD directly in serum. This in-solution technology enables the detection of antigen-antibody interactions by measuring the changes in hydrodynamic radius (Rh) of the labeled antigen upon binding to the antibody. As a result, MDS allows the accurate detection and characterization of antibodies directly in serum, thus eliminating the constraints of surface-bound technologies.<sup>4</sup>

## Results

To assess the binding affinity of the anti-spike S1 antibody to the RBD of the SARS-CoV-2 spike protein, the antibody was titrated against a constant concentration of 20 nM Alexa Fluor 647 labeled recombinantly expressed RBD. As a control, the titration experiment was first performed in buffer. Figure 2A shows the affinity binding curve measured in PBS with 0.05% Tween 20, yielding a KD of  $9.6 \pm 1.7$  nM.

For the measurements in human serum, the same antibody concentrations were titrated against 20 nM Alexa Fluor 647 labeled RBD, with the antibody diluted in serum. Figure 2B depicts the corresponding binding curve after background subtraction. Dependent on the dilution factor of the unlabeled anti-spike S1 antibody, the respective serum concentrations ranged from 91–97%, and, despite the high concentrations of serum in these samples, the KD value determined for this interaction matches that in PBS.

## Conclusion

Here we show that by using MDS on the Fluidity One-W Serum we can accurately detect and characterize the binding affinity of antibodies to virus proteins directly in human

serum. Thus, this technology could be used for in-depth analysis of the humoral immune response against SARS-CoV-2 to support the development of reliable antibody tests and vaccines in the fight against the COVID-19 pandemic.

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## Adjustable tip spacing multichannel pipettes

The Eppendorf Move It adjustable tip spacing multichannel pipettes offer an efficient, safe and synchronous way to pipette multiple samples from different source to destination formats. The pipettes have adjustable tip cones or channels to enable users to pipette 4–12 samples simultaneously, and between different tube (1.5/2 mL) and plate formats (12, 24, 48 or 96 wells).

The distance between the pipette tips can be easily set using the spacing control and predefined settings for different plate formats. Once the tip distance is set for source and destination, users can transfer samples between the two formats quickly by switching back and forth with a simple turn of the adjustment knob.

The Move It pipettes use a piston cylinder (no tubing) system to adjust the tip cone and channel distance, designed to provide the user with several advantages: no cable tangling, less maintenance and autoclavability due to the tubeless system, and reduced heat transfer to the air-cushion as the piston cylinder is directly connected to the nose cone for pipetting precision.

The pipette head is fully rotatable (360°), enabling users to easily change the orientation of the pipette when pipetting between two labware formats, and view the display for fast identification of settings. The pipettes are supported by Eppendorf's PhysioCare Concept and are ergonomically designed to minimise physical tension for comfortable handling.

Users can choose either a mechanical Research plus or electronic Xplorer plus Move It pipette, and select 4, 6, 8 and 12 channels and different volume ranges (15–300, 30–300, 120–1200, 50–1200  $\mu$ L) to suit all applications.

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The Thermo Fisher Scientific AmpliScribe Solution is a molecular diagnostic testing system that leverages the company's Applied Biosystems QuantStudio 7 Flex Real-time PCR instruments along with liquid handling products from Tecan. The modular solution delivers test results in a four-step process requiring minimal hands-on time, laboratory space and staffing resources.

The system utilises Thermo Fisher's Applied Biosystems TaqPath COVID-19 Combo Kit — a fast, sensitive multiplex diagnostic test that contains the assays and controls needed for the qualitative detection of nucleic acid from SARS-CoV-2. It also includes instruments from Tecan's Fluent Laboratory Workstation family.

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# Microscope captures brain neuroactivities in a mouse

US and Hong Kong researchers have used a novel high-speed microscope to record the electrical signals in the neurons of an alert mouse, in a significant breakthrough for the field of neuroscience. Their work has been published in the journal *Nature Methods*.



*Pictured: Dr Kevin Tsia, Associate Professor of Department of Electrical and Electronic Engineering, HKU.*

**O**ur brains contain tens of billions of nerve cells (neurons) which constantly communicate with each other by sending chemical and electrical flashes — each lasting just 1 ms. In every millisecond, these billions of swift-flying flashes form a giant star-map in the brain that lights up in a glittering pattern. They are the origins of all body functions and behaviours — such as emotions, perceptions, thoughts, actions and memories — as well as brain diseases such as Alzheimer's and Parkinson's in the case of abnormalities.

One grand challenge for neuroscience in the 21st century is to capture these complex flickering patterns of neural activities — the key to an integrated understanding of brain-wide interactions — which would have previously required a high-speed microscope into the brain. This has now changed, thanks to the development of a two-photon fluorescence microscope by a team led by Dr Kevin Tsia from The University of Hong Kong and Professor Ji Na from the University of California, Berkeley.

At the heart of the microscope is an innovative technique called FACED (free-space angular-chirp-enhanced delay imaging), developed by Dr

Tsai's team back in 2017. FACED makes use of a pair of parallel mirrors, which generate a shower of laser pulses to create a superfast sweeping laser beam at least 1000 times faster than the existing laser-scanning methods.

In the team's experiment, the microscope projected a beam of sweeping laser over the mouse's brain and captured 1000–3000 full 2D scans of a single mouse brain layer (the neocortex) every second. To probe the genuine electrical signals that pulse between the neurons, the team inserted a biosensor (protein molecules), developed by Dr Michael Lin of Stanford University, into the neurons of the mouse brain.

"These engineered proteins will light up (or fluoresce) whenever a voltage signal passes through the neurons," Dr Tsia said. "The emitted light is then detected by the microscope and formed into a 2D image that visualises the locations of these voltage changes.

"This is really an exciting result, as we now can peek into the neuronal activities that were once obscured and could provide the fundamental clues to understanding brain functions and, more importantly, brain diseases."

Apart from electrical signals, the team also used the microscope to capture the slow motion of chemical signals in the mouse brain, such as calcium and glutamate, a neurotransmitter, as deep as one-third of a millimetre from the brain's surface.

A notable advantage of this technique is the ability to track the signals that do not trigger the neuron to fire — weak neuronal signals (sub-threshold signals) that are often difficult to capture and detect. These have yet been studied in detail because of the lack of high-speed techniques like the one developed by the team.

Another important feature of the novel technique is that it is minimally invasive. The classical method for recording electrical firing in the brain is to physically embed or implant electrodes in the brain tissue. However, such physical intrusion could cause damage to the neurons and can only detect fuzzy signals from a couple of neurons.

"This is so far a one-of-its-kind technology that could detect millisecond-changing activities of individual neurons in the living brain," Dr Tsia said. "So this is, I would say, the cornerstone of neuroscience research to more accurately decoding brain signals."

Dr Tsia said the team would work to advance the capability of the microscope, stating, "We are working to further combine other advanced microscopy techniques to achieve imaging at higher resolution, wider view and deeper into the brain in the neocortex, which is about 1 mm. This will allow us to probe deeper into the brain for a better and more comprehensive understanding of the functions of the brain."



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# How to maximise grape yield during wine production

Winemaking is a multifaceted process with variables in each step. Grape pressing is one of the more important tasks: how and when it's done can affect the flavour of the finished product, and also can play a key role in producing a higher yield. Winery managers know that efficiency during grape pressing helps increase production and ultimately boosts profitability.

## From vine to wine: the crushing saga of a grape

After the initial crushing, pressing and de-sludging are complete, the remaining residue of skin and seeds is called the 'grape marc' or 'grape pomace'. Vintners have discovered that sometimes enough moisture remains in the grape marc to warrant another pressing, resulting in additional useable liquid from that particular batch. To determine if it's worth the effort, they can verify the moisture content in a sample of the grape marc.

## A toast to efficiency

Moisture analysers provide a rapid alternative to the time-consuming task of oven testing. The PMB from Adam Equipment speeds up the drying process and eliminates the possibility of burning a sample and getting false results.

The PMB features a single circular 400 W energy-efficient halogen bulb, which heats the specimen in 1°C selectable increments. A large, circular heating chamber is designed to heat samples evenly. Three heating options provide the flexibility to customise temperatures and test methods. The standard setting heats to one temperature in one step. For the ramp setting, the user chooses a temperature and sets the amount of time for the heat to reach that temperature. The step setting lets the user program up to three temperatures and times at each temperature.

For wine production control, the process is simple. Evenly spread approximately 20 g of the grape marc on the aluminium sample pan and run the sample at 100°C on the single heat setting. Temperature in the weighing chamber is monitored by a sensor. As the temperature approaches the final value, the heating bulb cycles on and off to maintain the designated temperature. Drying takes between 30 and 120 min, depending on the amount of residual moisture in the grape marc.

The initial temperature increase happens quickly, taking about a minute to reach 90% of the final temperature, and then another 30 seconds to reach the final figure. This method keeps the temperature from rising above the set point, eliminating possible damage to the sample. To monitor progress, PMB provides current results at set intervals.

## Varietal versions of the PMB

Adam offers three models — PMB 53 features a capacity of 50 g and readability of 0.01%/0.001 g; PMB 163 features a capacity of 160 g and readability of 0.01%/0.001 g; and PMB 202 features a capacity of 200 g and readability of 0.05%/0.01 g.

Connecting with other devices is simple, as the PMB offers both a USB port and RS-232 interface. Users can log or print information, communicate with computers or transmit test programs and results. There is no need for additional software to take readings, giving users freedom to collect data in any location. The internal memory stores up to 99 test results; extra results can be saved to a flash drive or computer to quickly verify and compare readings.

The PMB retains and stores set-up information, saving the time and effort of having to re-enter the information in the next analysis. An ergonomic design features handles on both sides for ready access, and a pan lifter is provided for placing and changing samples.

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## Face shields

Ned's Head Personal Protective Face Shields have been specially designed to add a layer of protection from sneezes, coughs or other airborne particles. The face shields are made from recyclable materials and the latex-free, sticker-free and adhesive-free design was crafted by professional industrial designers with medical design experience. They can be easily disassembled and cleaned with most cleaning products, with no deterioration in performance over time.

Allowing for clear vision while being comfortable to wear, the face shields are a suitable alternative face covering for people who cannot wear face masks, including those with asthma. The shields provide comfort for wearers with a make-up of lightweight materials, a breathable foam headband that is not sweaty like plastic or elastic, and an anti-fog coating so that people can comfortably wear glasses underneath. They are also compatible with face masks, for anyone who'd like to wear one underneath while also protecting their face and eyes with a shield.



The design encourages good hygiene habits by reminding the wearer that they cannot touch their face, and to not eat or drink while wearing the shield. They should allow for better visual communication than a face mask, as the wearer's facial expressions are clearly visible. The shields have been tested for spray resistance and so should offer protection from catching viruses through the eyes and droplets, unlike regular face masks.

The face shields are registered with the Australian Therapeutic Goods Administration and are an approved supplier for South Australian Government Health.

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| • Myc-Trap        | • TurboGFP-Trap      |

Note: Dynabeads™ is a registered trademark of Life Technologies Corporation, a part of Thermo Fisher Scientific Inc.

**Experience the Alpaca Antibody Advantage**

## Immunoassay for in-solution affinity profiling

Fluidity One-W Serum is a novel in-solution immunoassay platform that allows researchers to characterise and quantify antigen-antibody interactions directly in minimally diluted serum.

Traditional immunoassays such as ELISAs combine affinity and concentration into a single, less-precise measure known as titre, which cannot readily distinguish between large numbers of weak-binding antibodies and small numbers of strong-binding antibodies. Other technologies which rely on attaching antigens to surfaces have the ability to measure affinity in purified systems, but experience difficulty doing so in complex backgrounds such as plasma and serum due to non-specific binding and other surface constraints. These limitations can have major implications for plasma transfer treatments, vaccine and therapeutic development, and the ongoing monitoring of immunity.

The Fluidity One-W Serum has the ability to independently quantify antibody affinity and concentration directly in patient serum, which should allow a deeper, more accurate understanding of the immune system.

Other product highlights include: characterisation of protein interactions in solution using microfluidic diffusional sizing (MDS); the ability to measure in complex backgrounds such as minimally diluted serum; no binding artefacts or non-specific binding; no surface constraints; independent determination of antibody concentration and affinity for a comprehensive immune response assessment; an easy-to-use interface and consumable management; and disposable single-use chips and contained waste, minimising the risk of cross-contamination.

**ATA Scientific Pty Ltd**

[www.atascientific.com.au](http://www.atascientific.com.au)





# Fast data acquisition with a high-speed spectrometer

US researchers have developed an advanced spectrometer that can acquire data with exceptionally high speed, and could be useful for applications including remote sensing, real-time biological imaging and machine vision.

**S**pectrometers measure the colour of light absorbed or emitted from a substance. However, using such systems for complex and detailed measurement typically requires long data acquisition times.

Now, researchers from the US National Institute of Standards and Technology (NIST) have reported what is claimed to be the first dual-comb spectrometer with a pulse repetition rate of 10 GHz. They demonstrated their device by carrying out spectroscopy experiments on pressurised gases and semiconductor wafers, with the results published in the journal *Optics Express*.

“Frequency combs are already known to be useful for spectroscopy,” said lead author David R Carlson, also from the University of Colorado Boulder. “Our research is focused on building new, high-speed frequency combs that can make a spectrometer that operates hundreds of times faster than current technologies.”

“Our new system can measure a spectrum in mere microseconds,” added research team leader Scott B Papp. “This means it could be used for chemical studies in the dynamic environment of power plants or jet engines, for quality control of pharmaceuticals or semiconductors flying by on a production line, or for video imaging of biological samples.”

## Getting data faster

Dual-comb spectroscopy uses two optical sources, known as optical frequency combs, that emit a

spectrum of colours — or frequencies — perfectly spaced like the teeth on a comb. Frequency combs are useful for spectroscopy because they provide access to a wide range of colours that can be used to distinguish various substances.

To create a dual-comb spectroscopy system with extremely fast acquisition and a wide range of colours, the researchers brought together techniques from several different disciplines, including nanofabrication, microwave electronics, spectroscopy and microscopy.

The frequency combs in the new system use an optical modulator driven by an electronic signal to carve a continuous laser beam into a sequence of very short pulses. These pulses of light pass through nanophotonic nonlinear waveguides on a microchip, which generates many colours of light simultaneously. This multicolour output, known as a supercontinuum, can then be used to make precise spectroscopy measurements of solids, liquids and gases.

The chip-based nanophotonic nonlinear waveguides were a key component in this new system. These channels confine light within structures that are a centimetre long but only nanometres wide. Their small size and low light losses, combined with the properties of the material they are made from, allow them to convert light from one wavelength to another very efficiently to create the supercontinuum.

“The frequency comb source itself is also unique compared to most other dual-comb systems because it is generated by carving a continuous laser beam into pulses with an electro-optic modulator,” Carlson said. “This

means the reliability and tuneability of the laser can be exceptionally high across a wide range of operating conditions — an important feature when looking at future applications outside of a laboratory environment.”

## Analysing gases and solids

To demonstrate the versatility of the new dual-comb spectrometer, the researchers used it to perform linear absorption spectroscopy on gases of different pressure. They also operated it in a slightly different configuration to perform nonlinear Raman spectroscopy on semiconductor materials. Nonlinear Raman spectroscopy, which uses pulses of light to characterise the vibrations of molecules in a sample, has not previously been performed using an electro-optic frequency comb.

The high data acquisition speeds that are possible with electro-optic combs operating at gigahertz pulse rates are ideal for making spectroscopy measurements of fast and non-repeatable events.

“It may be possible to analyse and capture the chemical signatures during an explosion or combustion event,” Carlson said. “Similarly, in biological imaging the ability to create images in real time of living tissues without requiring chemical labelling would be immensely valuable to biological researchers.”

The researchers are now working to improve the system’s performance to make it practical for applications like real-time biological imaging and to simplify and shrink the experimental set-up so that it could be operated outside of the lab.



## Fluid bed systems

Fluid Air fluid beds offer an effective solution when drying, coating and granulating are desired. Fluid Air values the importance of having high-performance componentry in its designs, hence the use of high-pressure, high-flow process blowers on all its fluid beds.

The high-pressure blowers are designed to ensure that even the heaviest material has the required lift inside the fluidising chamber, increasing the process efficiency and decreasing process time. The use of a variable frequency drive should ensure the exact amount of airflow is available at the system at any given time, while design flexibility enables peak performance for fluid bed dryers, granulators and coaters. The company can help with solid dosage technology for R&D, pilot or production applications.

MAGNACOATER Wurster coaters are robust with high quality. The company offers options including the MAGNACOATER plate, flared partitions, an air balancing system for even air distribution, self-cleaning and removable nozzles, perimeter air enhancement, optimal spray nozzle design, self-monitoring liquid delivery systems and ultrasonic nozzles.

The Fluid Air MAGNAFLO is another fluid bed dryer/granulator concept that contains deep inlet Plenum, Conidur or Turboflo bed plates, an agitator rake, a conical expansion chamber with a choice of filter systems, high W/C fan ratings, scale-up options and manifold ring LD assembly.

**Spraying Systems Co Pty Ltd**

[www.spray.com.au](http://www.spray.com.au)

## Assay for SARS-Cov-2 neutralising antibodies

The need to evaluate neutralising antibodies to fight the SARS-CoV-2 virus is at an all-time high, but current screening methods — including the plaque reduction neutralisation assay and other live virus cell-based tests — can require multiple days to complete. In the pursuit of another solution, Leinco Technologies collaborated with ADMA Biologics to develop the COVID-19 ImmunoRank Neutralization MICRO-ELISA — a 96-well ELISA-based assay for evaluating convalescent plasma and antibody therapies and determining the effectiveness of vaccines for COVID-19.



The fully validated assay is intended for use as an aid in identifying individuals with an adaptive immune response to SARS-CoV-2, indicating recent or prior infection, and detection of circulating SARS-CoV-2 neutralising antibodies of all Ig classes. SARS-CoV-2 receptor binding domain (RBD) specific antibodies can block angiotensin-converting enzyme 2 (ACE2) binding. RBD-specific neutralising antibodies have been identified in the plasma of convalescent COVID-19 survivors. Therefore, identifying high titre convalescent plasma is an important tool for the development of therapy. Monitoring serum for circulating SARS-CoV-2 neutralising antibodies during vaccine development to determine continued protective immunity would be another important application of the ImmunoRank assay.

With the ability to test up to 90 samples per test kit with 99.8% specificity, the assay should provide researchers with an important tool to develop therapies and vaccines to fight the war against SARS-CoV-2.

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## Scanning electron microscope

Thermo Fisher Scientific has unveiled the Thermo Scientific Apreo 2 scanning electron microscope (SEM) — a high-performance field emission SEM that offers easy-to-obtain nanometre-scale information at a range of working distances and operating conditions. The product was designed to help investigators, SEM operators and lab managers deliver expert results, regardless of experience level.

The device integrates Thermo Fisher's ColorSEM technology, enabling researchers to view and analyse live colour images directly within the SEM user interface (UI) without switching to conventional energy dispersive X-ray spectroscopy (EDS) analysis software. Researchers can obtain elemental data almost instantly — up to 10 times faster than was possible with conventional techniques, according to the company — quickly identifying areas of interest for further exploration.

The SEM is designed to keep itself always aligned and ready to image with improved stability and SmartAlign automation, allowing researchers to focus on their sample work, not on the microscope. In addition, the product features auto-focus, auto-stigmator and auto-lens alignment technology — each intended to reduce the need for training and enable any user to obtain high-quality results.

The device features 1 nm resolution at a 10 mm working distance, allowing users to acquire high-quality images without worrying about microscope components colliding or damaging the sample. High-resolution imaging at long working distance also enables users to pair the best imaging conditions with optimised analytical data collection.

The product is said to feature improved imaging performance compared to the Apreo 1, at very low beam energies, making it applicable for nanomaterials, polymers and hydrated samples. Improvements at higher beam currents allow for higher-contrast imaging and improved analytical throughput compared to the Apreo 1 and, when combined with ColorSEM, scientists can generate analytical results even faster than the Apreo 1.

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## Wireless temperature and humidity data logger

The RFL100 data loggers use Vaisala's proprietary VaiNet wireless technology to monitor environments ranging from warehouses to production areas to cleanrooms and laboratories. VaiNet wireless technology is based on the LoRa modulation technique to provide a robust wireless signal that is designed to be reliable over long distances and in complex, obstructed conditions. This wireless technology allows each data logger's signal to travel over 100 m without the aid of signal amplifiers or repeaters.

The RFL data loggers combine with viewLinc Enterprise Server software version 5.0 and later. They connect to the VaiNet network using the Vaisala Access Point AP10. The data loggers are suitable for monitoring, alarming and reporting temperature and humidity in controlled environments. The RFL100 is also available as a temperature-only data logger.

Other features include temperature and relative humidity measurement precision, and a dedicated mounting bracket with temporary and permanent mounting methods (including optional magnets).

**Vaisala Pty Ltd**

[www.vaisala.com/lifescience](http://www.vaisala.com/lifescience)



## UV ring light for stereo microscopes

SCHOTT's VisiLED UV Ring Light for stereo microscopes combines classic bright-field illumination with UV illumination.

The company says it is the only segment ring light on the market in which white-light and UV LEDs are alternately installed in eight segments. This LED arrangement allows objects to be examined from the same illumination angle, which improves the ability to compare and reproduce resulting images.

While the homogenous white light displays samples in natural colour, UV excitation reveals previously invisible parts of the sample through fluorescence. The SCHOTT MC 1100 Controller makes it easy to switch between the two illumination modes.

**Coherent Scientific Pty Ltd**

[www.coherent.com.au](http://www.coherent.com.au)



## Portable dry block temperature calibrator

IKM Instrutek's TC65 calibrator features a touch display and an extended calibration interval of up to three years. With a contemporary design that is easy to use and read, it has been developed to meet tough environmental demands.

The dry block principle excludes the use of oil or other liquids. A dry block insert with various diameters ensures thermal contact to the sensor being tested. Simply place the sensor to be calibrated in the calibrator and set the temperature; when stabilisation occurs, read the true temperature from the calibrator and recalibrate the sensor or system accordingly.

Compact, robust and approved according to DNVGL-CG-0339:2019, the unit has been designed for marine, industrial and laboratory use. This should ensure that users are able to calibrate a vast range of temperature sensors, thermometers and temperature switches/thermostats. The product has a temperature range of 30 to 650°C, stability of  $\pm 0.1^\circ\text{C}$ , one-year accuracy of  $\pm 1.5^\circ\text{C}$  and three-year accuracy of  $\pm 3.5^\circ\text{C}$ .

**AMS Instrumentation & Calibration Pty Ltd**

[www.ams-ic.com.au](http://www.ams-ic.com.au)



## Repeater pipette

Socorex's crystal blue repeater pipette Stepper 416 is now available as a replacement of the former 411 model. The instrument is suitable for serial reagent distribution, aliquoting samples, running test kits and dispensing viscous liquids. High-purity grade, sterile Ecostep **bioproof** syringes extend its use in the microbiology, molecular biology and genetic fields.

The compact instrument is intended for serial dispensing from 10 to 5000  $\mu\text{L}$ . Associated with three Ecostep syringes, it provides a broad choice of 53 different volumes and up to 73 doses per filling.

The product's trigger action mechanism is designed to eliminate thumb fatigue. It enables a precise activation movement and is suitable for repeat dispensing, aliquoting, tubes and plate filling.

**Interpath Services Pty Ltd**

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## Custom laminar airflow systems

Airepure Australia (a Camfil Group company) designs, supplies, installs and services controlled unidirectional airflow systems for cleanroom environments.

Custom products include laminar air downflow units, cabinets, booths and ceilings; pass through hatches and cabinets; air showers; laminar downflow and hybrid downflow ventilation systems (including UCV systems); and terminal, ducted and safe change HEPA housing systems.

The company advises that its in-house engineers are experienced with the technological aspects of laminar flow air quality control and the different standards that apply to each application, and can provide custom laminar air flow systems to suit specific needs and requirements.

Airepure's NATA certified onsite technicians can also service existing laminar flow systems through the replacement and testing of HEPA filters to meet Australian Standards and state healthcare regulations.

**Airepure Australia Pty Ltd**  
[www.airepure.com.au](http://www.airepure.com.au)

## Spatial biology profiler

The GeoMx Whole Transcriptome Atlas (WTA) is a reagent solution designed for comprehensive profiling of spatial biology using the NanoString GeoMx Digital Spatial Profiler (DSP) system.

Select any particular cells under the microscope and quantify the RNA molecules they express with single-molecule digital precision. The WTA profiles RNA expression from over 18,000 genes in human and over 21,000 genes in mouse with spatial resolution in any region of interest from a single tissue section. Users can therefore explore any target and any in their selected regions of interest.

The product is optimised for preserved FFPE samples as well as fresh frozen tissue. The particular cells to profile are identified and targeted using fluorescently labelled protein antibodies or RNAscope morphology markers. Molecule counting is done with next-generation sequencer (NGS) readout and is compatible with NanoString's DSP Data Center for data analysis and storage.

**Bio-Strategy Pty Ltd**  
[www.bio-strategy.com](http://www.bio-strategy.com)



## Big Endothelin-1 ELISA

Endothelin-1 (ET-1) is a potent vasoconstrictor secreted by vascular endothelial cells. Due to its high biologic activity, the half-life of ET-1 (1-21) in plasma is less than 1 min, which may preclude its use as a diagnostic marker, whereas clearance of the precursor peptide Big Endothelin-1 is much slower. As Big Endothelin-1 is produced at amounts equimolar to ET-1 and has higher plasma stability, it is more suitable for diagnostics and monitoring of heart failure. Hence, Big ET-1 has the same physiological role as ET-1 while being a more appropriate marker and has been implicated in the pathophysiology of numerous cardiovascular diseases.

The Big Endothelin-1 immunoassay from Biomedica is a 5.5 h, 96-well sandwich ELISA for the direct measurement and quantitative determination of Big Endothelin-1 in serum and plasma. The assay employs human serum-based standards to ensure the correct measurement of biological data, is fully validated according to FDA/ICH/EMA guidelines and is highly cited.

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### Life science/laboratory decontamination

Decontamination should be considered at multiple times through the life cycle of the laboratory — post-construction, before commissioning, during the useful life and as part of decommissioning, and finally prior to demolition.

In normal day-to-day operations, instrument servicing, filter change for cabinets or HVAC will require consideration of the need to disinfect prior to works. Australian and New Zealand Standard AS/NZS 2982 Laboratory Design states that people working on or in the laboratory should be made aware of the hazards present in the laboratory and any precautionary decontamination procedure.

For laboratories that have been established for several years, current use may not be reflective of historical use. In these cases it is especially important to have the laboratory, HVAC, chemical fume cupboards/hoods, liquid waste systems and equipment properly decontaminated prior to works being done, to ensure appropriate safe access and disposal of contaminated materials.

Laboratory hardware that is disposed of without decontamination shall be treated as hazardous waste, generally a costly endeavour. Laboratory and facility managers have a duty of care to make sure that laboratories are correctly decontaminated and that an occupational hygienist completes the appropriate pre- and post-decontamination tests.

Biosafety provides Department of Health & Human Services/DG trained technicians to clean and decontaminate laboratories. The company has extensive experience in understanding and dealing with biological, chemical, radioactive and physical contamination issues.

Biosafety can provide both decontamination services and occupational hygiene testing/clearance certificates.

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## Nanopositioning stages

The Nanoscan SP range of Piezo-driven stages from Prior Scientific delivers high positioning performance and fast recovery between Z stacks. The stages are compatible with many Prior motorised stages as well as many common microscopes when using appropriate adapter plates. The 400 and 600  $\mu\text{m}$  closed loop versions have a slim height of 13.7 mm, providing good access for illumination of the sample area.

The nanopositioning stages are suitable for all types of confocal microscopy, live cell imaging, 3D imaging/data collection, laser- and image-based autofocus systems and high content screening applications. Accessory insert plates are available for a wide variety of samples, including well plates, slides and petri dishes, as is an extra-large sample holder area for well plates, dishes, multi slide holders, incubators and custom applications.

The stages are suitable for both high-speed Z stacking and high-speed constant velocity motion applications. They allow ultimate full digital control with pre-calibrated, user-selectable load and speed profiles for optimising performance. Step settle times of  $<10$  ms are achievable and capacitive sensors enable repeatable positioning and resolution.

The product is tested to function for  $>10$  million full range cycles. User-configurable settings can be optimised for different sample masses sizes and performance needs; the user simply selects the best setting for their application. Connectors with built-in stage calibration provide plug-and-play electronics that can be interchanged, minimising system downtime.

The powerful digital NPC-D-6110 controller drives the device faster and provides motion control algorithms with acceleration/deceleration control and active damping to reduce overshoot. A velocity control algorithm offers ultrasmooth ramps for applications such as focus stacking or focus bracketing. The controller allows 20  $\mu\text{s}$  update rates and fast recovery time between Z stacks, providing enhanced time resolution. Selectable tuning presets optimise for step settle, objective mass and resolution.

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## Engagement through collaboration the key to a successful laboratory build

For close to two decades, Star Scientific has been working on how humanity can transition to a new energy economy. With recent growth of their breakthrough technology, the 'Hydrogen Energy Release Optimiser' — creating limitless, efficient, affordable, clean and reliable power and heat — Amicus was engaged to develop their new office space in Berkeley Vale, converting the existing warehouse into a **multipurpose laboratory environment**.

The brief was to create a **professional, high-quality** space comprising a control room, wet laboratory, material preparation laboratory, material analysis laboratory, XPS room and administrative room. Amicus has a longstanding relationship with Star Scientific, having successfully delivered 5 laboratories in 2016 at their former premise at Mayfield West.

Amicus continued its close working relationship with Star Scientific, managing all aspects of the project from design, council approvals, construction right through to handover. Having relocated from a 150sqm space to a 670sqm space in Berkeley Vale, the key driver for the move was to not only

replicate the services at Mayfield West, but to provide **flexibility** for impending growth, futureproofing the space.

In many laboratory environments, there is an emphasis on function over the aesthetic; however, Star Scientific wanted a **creative and sophisticated design**, reflecting their brand and ethos to their team and clients. With a focus on flexibility, the concept was modular by design, providing an abundance of workspaces and moveable joinery pieces, also repurposing some existing furniture. It was important we understand the workflow process and how adjacent laboratories integrated. Due to our level of detail, we were able to effectively provide solutions, overcoming challenges, to ensure the design was compliant and fit-for-purpose.

Our understanding of our clients' vision, having analysed the function of their existing laboratory spaces, meant we were able to effectively incorporate design tweaks to improve functionality and performance within the new space.

Complementing their expansion, an experimental bay was added to the scope

during the construction process. We delivered bespoke fencing and furniture including Terrazzo balance benches, purpose-built gas cages and fume cupboards. This space also included power, data, hydrogen and oxygen services. Due to the combination of these highly volatile gases, strict adherence and coordination with a dangerous goods certifier was required, who assisted with compliance and design.

**For more information on our Laboratory Solutions visit our website:**

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## 59th ASMR National Scientific Conference

November 18–19, online

The 59th ASMR National Scientific Conference (NSC) will explore the future of health and medical research, shining a light on the importance of basic, fundamental science in driving clinical translation and implementation. The NSC is an inviting space for student, early-career, mid-career and senior researchers to take a fresh approach to discovery and communication. The online program is set to excite, inspire and generate new and innovative exchanges and collaboration between researchers from all areas of health and medical research.  
<https://asmr.org.au/nsc-welcome/>

### AusBiotech + Invest 2020

October 28–30, online  
<https://www.ausbiotechnc.org/>

### 2020 COSA ASM

November 11–13, online  
<https://www.cosa2020.org/>

### Global Academic Programs (GAP) Conference

November 16–19, online  
<https://www.gap2020.com.au/>

### Linking the Galactic and Extragalactic

December 3–4, online  
<http://extragalactic-milkyways.org/>

### Eradicate Cancer 2020

December 14–16, Melbourne  
<https://www.eradicatecancer2020.org/>

### 43rd COSPAR Scientific Assembly

January 28–February 4, Sydney  
<http://www.cospar2020.org/>

### ICHS Symposium on Infections in the Immunocompromised Host

January 31–February 2, Melbourne  
<https://ichs2021.org/>

### Lorne Proteomics 2021

February 4–7, various  
<https://www.lorneproteomics.org/>

### Lorne Proteins 2021

February 8–10, Lorne and online  
<https://www.lorneproteins.org/>

### Lorne Cancer 2021

February 11–13, Lorne  
<https://www.lornecancer.org/>

### Lorne Infection & Immunity 2021

February 17–19, online  
<https://www.lorneinfectionimmunity.org/>

### Science Meets Parliament 2021

March 15–17, Canberra  
<https://scienceandtechnologyaustralia.org.au/what-we-do/science-meets-parliament/>

### ASID Annual Scientific Meeting 2021

March 24–26, Melbourne  
<https://www.asid.net.au/meetings/ASM2020>

### TSANZSRS 2021

May 1–2, online  
<https://www.tsanzsrs2021.com/>

### Pathology Update 2021

July 2–4, Sydney and online  
<https://www.rcpa.edu.au/Events/Pathology-Update>

### 2021 ISFPX and ASP Annual Conference

July 5–8, Cairns  
<https://www.isfpix.org/>

### FOODCONF 2021

July 12–14, Melbourne  
<https://www.foodconferencesaustralia.com/>

### 20th International Conference on Biological Inorganic Chemistry

July 18–22, Adelaide  
<https://www.icbic2021.org/>

### foodpro 2021

July 25–28, Sydney  
<https://foodproexh.com/>

### HGSA 44th Annual Scientific Meeting

August 14–17, Adelaide  
<https://aacb.eventsair.com/hgsa-44th-annual-scientific-meeting/>

### ACS 43rd Annual Scientific Meeting 2021

August 24–28, Queenstown  
<https://acs2020.org.au/>

### ASCI 2021 Conference

September 1–3, Melbourne  
<https://www.ascia2021.com/>

### Energy Oceania 2021

September 6–8, Melbourne  
<https://www.energyconferenceaustralia.com/>

### Australasian Exploration Geoscience Conference

September 15–20, Brisbane  
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#### Head Office

Unit 7, 6-8 Byfield Street,  
(Locked Bag 2226)  
North Ryde BC NSW 1670,  
AUSTRALIA  
Ph: +61 2 9168 2500

#### Editor

Lauren Davis  
[LLS@wfmedia.com.au](mailto:LLS@wfmedia.com.au)

#### Publishing Director/MD

Geoff Hird

#### Art Director/Production Manager

Julie Wright

#### Art/Production

Colleen Sam, Veronica King

#### Circulation

Dianna Alberry, Sue Lavery  
[circulation@wfmedia.com.au](mailto:circulation@wfmedia.com.au)

#### Copy Control

Mitchie Mullins  
[copy@wfmedia.com.au](mailto:copy@wfmedia.com.au)

#### Advertising Sales

Sales Manager: Kerrie Robinson  
Ph: 0400 886 311  
[krobinson@wfmedia.com.au](mailto:krobinson@wfmedia.com.au)

Nikki Edwards

Ph: 0431 107 407  
[nedwards@wfmedia.com.au](mailto:nedwards@wfmedia.com.au)

Tim Thompson

Ph: 0421 623 958  
[tthompson@wfmedia.com.au](mailto:tthompson@wfmedia.com.au)

If you have any queries regarding our privacy  
policy please email [privacy@wfmedia.com.au](mailto:privacy@wfmedia.com.au)

Printed and bound by  
Dynamite Printing

Print Post Approved PP100008671

ISSN No. 2203-773X

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