

# Lab+Life SCIENTIST

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# Contents



## 6 IMPROVING EFFICIENCY AND SAFETY IN AUSTRALIAN LABS

Consultants are using a risk-based approach to the storage of hazardous products in laboratories.

## 15 JUST ADD WATER

A new molecular manufacturing method can produce a broad range of biomolecules anywhere in the world.

## 22 THE MYSTERY OF THE DIMMING GALAXY AND THE STARVING BLACK HOLE

Astronomers have discovered the secret behind a change in the behaviour of a supermassive black hole in a distant galaxy.

## 25 HOW MUCH NEANDERTHAL DNA IS IN MODERN HUMANS?

What sort of effect did our ancestors' interbreeding with Neanderthals have on the DNA of modern humans?

## 28 LEUKAEMIA CELLS RUN BUT DON'T HIDE

Leukaemia cells are not playing 'hide and seek', as traditionally believed, but are actually playing a game of 'tag'.

## 32 WE COULD GROW JET FUEL ON GUM TREES — IF THERE'S ANYWHERE LEFT TO PLANT THEM

Scientists are one step closer to using gum trees to develop renewable jet and missile fuel.

## 38 HOW SOFTWARE CAN IMPROVE BIOFUELS PRODUCTION

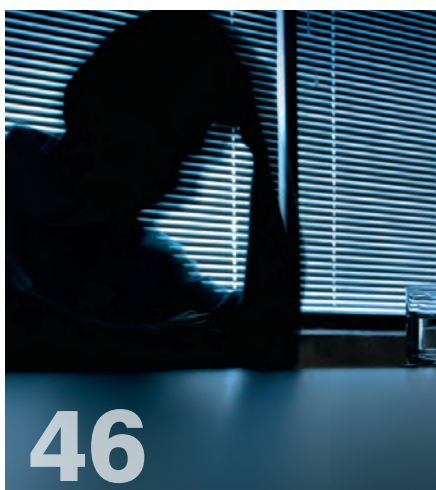
Labs servicing the rapidly growing biofuels industry will require new instruments and generate more data.

## 43 DEWETTING — THE OPPOSITE OF SPREADING

Researchers have made the first ever direct observation of the elusive dewetting process.

## 46 FAULTY GENE LINKED TO ASTHMA, DIABETES AND DEPRESSION

There is a physiological link between asthma, heart disease and depression that leads back to a single faulty gene.



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The 2016 Professional Scientists Employment and Remuneration Report, recently released by Professional Scientists Australia and Science & Technology Australia (STA), makes for sobering reading. Based on the results of a national survey, the report provides an overview of the pay and conditions of scientists across Australia. It can be downloaded in full or as a free summary from the Professionals Australia website.

The report shows that in the past year, average remuneration for scientists has increased by 2.4%, outperforming both the cost of living (1%) and the Wage Price Index (2.1%). However, more than one-third (32.9%) of respondents to the survey had received no pay increase in the previous year and the gender pay gap apparently persists, with women scientists' salaries averaging 83% of men's. As a woman myself, this made me particularly concerned.

But that's not all. While 46.5% of scientists surveyed reported being satisfied or very satisfied with their current level of remuneration, 35.2% were dissatisfied or very dissatisfied. Of the 34.8% of respondents who said they were considering leaving their current job, contributing factors included pay, lack of professional development opportunities and lack of work-life balance.

Cost-cutting paired with uncertainty of funding from year to year has created particular concern about the overall capability of research organisations to continue to do good work, with 80.9% of respondents agreeing or strongly agreeing that cost-cutting was affecting their organisation's science capability. More than half (56.4%) of respondents said staff morale had declined in the past 12 months, and 61% said worker fatigue had increased.

Professionals Australia CEO Chris Walton said the survey findings raise concerns about the sustainability of the science and R&D workforce with what appeared to be some quite serious systemic workforce issues, stating, "We need to ensure we maintain a science and technology workforce with the necessary skills and experience to support knowledge-based investment and drive innovation."

"To do this, we need to ensure that science-based organisations have as part of their human resources packages equitable and effective recognition and reward strategies and a commitment to maintaining a strong science capability in management and decision-maker roles," said Walton. "This is the only way we'll attract the next generation of scientists to the profession."

Clearly, several steps need to be put in place in order to keep Australia's scientists feel wanted and to encourage the current generation of STEM students to one day take their place. And while this little rant of mine is unlikely to make a difference, I would like to thank those of you who have stuck to your guns and continued in your professions in order to achieve some truly remarkable breakthroughs, just a few of which are showcased in this issue. From research into the human body, to Australia's own backyard, to several galaxies away, it is clear that Australia's scientists have not quite given up yet. And the more your achievements end up being acknowledged, the more you will hopefully be rewarded and reward us in turn with further good work.

Failing that, you could always combine your intellects and threaten us with some sort of superweapon until we worship you as our rightful lords and masters.

Regards,  
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Russell Urquhart, general manager of G3Lab, looks at how the European Standard EN 14470-1 compares to those governing storage cabinets in Australia and how Australian consultants are using a risk-based alternative approach to the storage of hazardous products in laboratories and other facilities.

In the Australian lab design code AS2982, it is recommended that no more than 30 L of class 3 flammable solvent be stored in a single underbench safety cabinet. The lab safety standard AS2243.10 recommends a minimum of 3 m between any class 3 safety cabinet and escape doors, and 10 m separation between aggregate dangerous goods of 250 L or more. The Australian flammables goods standard AS1940 recommends a maximum of 250 L of flammable goods in safety cabinets per 250 m<sup>2</sup> in multilevel buildings.

What do these regulations all have in common? They refer to double skin metal cabinets manufactured according to AS1940, which require no formal testing of fire resistance properties. For this reason, managers of labs and other large facilities are increasingly turning to dangerous goods consultants to investigate a risk-based method of flammable storage to challenge these restraints and raise the level of safety in Australian labs. Often the specified solution is a central fire-rated store with integrated spill containment, ventilation, explosion-proof lighting, access control, etc — in effect a ‘concrete bunker’, which can be very expensive and creates a lot of inefficiencies for users.

Fortunately, this issue has been addressed well in other parts of the world, resulting in the development and regulation of cabinets with a guaranteed fire rating, such as those manufactured to EN14470 by asecos in Germany.

#### The advantages of a 90-minute fire-rated safety storage cabinet

Once a cabinet with a proven fire rating is considered, the consultant can look more objectively at the flammable goods workflow and often increase the







“... managers of labs and other large facilities are increasingly turning to dangerous goods consultants to investigate a risk-based method of flammable storage”

amount of solvents stored within labs and work areas. If the EN approach is used as a guide, 90 minute fire-rated cabinets (type 90 cabinets) can be stored adjacent to each other, since they are wholly isolated from the fire and from each other for 90 minutes in a fire incident.

Efficiency is immediately improved, as time spent fetching flammable liquids from the central storage room to the workplace is minimised and all hazardous materials for daily use can be readily available, safely and conveniently, in the lab. An added benefit is the elimination of risks associated with moving flammable goods around the building through traffic areas such as corridors and lifts.

Safety cabinets in accordance with EN 14470-1 for flammable liquids provide a high degree of safety for personnel and the environment and give maximum protection to assets. They guarantee the highest fire protection available today, minimise the potential for explosions and prevent an existing fire from spreading. They will provide sufficient time for personnel to safely leave the building and for firefighters to rescue people from the building and extinguish a fire.

#### Meeting EN14470-1

The primary function for which a safety storage cabinet is intended is to shield stored, hazardous materials from a temperature rise of more than 200°C in the event of fire for the defined period of time. Combustion may begin if the temperature rise inside the safety storage cabinet exceeds 200°C, as many common class 3 flammable liquids will reach their autoignition temperature around 220°C (a room temperature of 20°C plus a temperature rise of 200°C), which is when they explode.

Whether in Munich or Melbourne, a fire has the same properties and temperatures. A temperature curve shows that after only 5 minutes, a fire has

reached a temperature of 576°C. After 30 minutes 842°C has been reached, and after 90 minutes the flames are at more than 1000°C. The contents of a double skin storage cabinet designed to AS1940 will follow much the same temperature curve.

#### Cabinet construction

A double-wall steel cabinet provides 3–10 minutes of protection before the interior has heated to 220°C. A type 90 safety storage cabinet provides 90 minutes of protection before the interior has heated to 220°C. That's almost 10 times more safety in the event of fire compared with a double-wall steel cabinet designed to AS1940.

#### Fire protection

In the event of a fire, the cabinet must ensure that, over a period defined by the manufacturer, its contents do not present an additional risk that the fire will spread. The cabinet doors must close entirely, starting from any position (closing time max 20 seconds).

#### Air inlet and outlet openings

The cabinets must have openings for air inlet and outlet (for connection of the cabinet to an exhaust system). The ventilation openings must close automatically at a temperature of 70°C. Shelves and drawers must be able to support the loading specified by the manufacturer over the period of the test in the furnace. The internal equipment of the cabinet must include a spill containment sump and the spill containment sump must retain its ability to function after the fire resistance test. This is to be checked visually by filling the spill containment sump with water.

#### Fire resistance

Each model must be independently verified by tests on a design sample. A fire-resistant cabinet is exposed to flames in a suitable furnace. The doors, walls and ceiling of the cabinet being tested must be exposed to the same heating conditions. Cabinets must be tested as free-standing single cabinets. The

flame exposure is carried out in accordance with the standard temperature curve of EN 1363-1 (5.1.1). The temperature rise is measured inside the cabinet. The cabinet will then be classed as type 15, 30, 60 or 90, according to the time that has elapsed before the temperature rose by 200°C.

#### EN 14470-2 — the highest standard for gas cylinder cabinets

Australian labs and industry are also taking advantage of 90 minute fire-rated gas cylinder stores designed to EN14470-2, for safety in the storage, provision and handling of gas cylinders in indoor areas.

Due to the high pressure and the contents (corrosive, toxic, flammable, fire accelerating), gas cylinders represent a significant potential hazard compared to flammable liquids. It is therefore usually recommended to store gas cylinders in outdoor areas. In practice, this is often not possible or is associated with very high costs. With the publishing of the EN standard for gas cylinder cabinets, EN 14470-2, an economical and flexible option for the installation of gas cylinders in indoor areas is now available that offers a level of safety comparable to that of outdoor storage.

#### Documentation

Fire resistance is classified into four classes, from G15 up to G90 (fire resistance of 15 up to 90 minutes).

Each type of cabinet and each cabinet size must to be type tested in a furnace. In case dimensional variation exceeds the tolerance, the cabinet must be retested again. Tests can only be executed by an authorised material testing institute.

EN 14470 parts 1-2 stipulates that the following documents are supplied with each fire-rated safety cabinet:

1. A test report of an authorised material testing institute stating/proving the successfully passed fire test.
2. A test certificate issued by an independent testing organisation.

This ensures compliance with regulations, safety for the user and clear identification of approval documents with the model of safety storage cabinet.

#### Conclusion

While the Australian standards mentioned above are a starting point for users looking for compliant solutions, EN 14470-1 and EN 14470-2 are providing some welcome and relevant guidance to Australian dangerous goods consultants and clients who are adopting a risk-based approach to dangerous goods storage to increase both efficiency and safety.

## World's most powerful X-ray creates a new type of crystal

An international team of scientists has inadvertently discovered how to create a new type of crystal using light more than 10 billion times brighter than the sun, reversing what has been accepted thinking in crystallography for more than 100 years.

The discovery occurred when the scientists exposed a sample of crystals, known as Buckminsterfullerene or Buckyballs, to intense light emitted from the world's first hard X-ray free electron laser (XFEL), based at Stanford University in the US. Light from the XFEL is around one billion times brighter than light generated by any other X-ray equipment — even light from the Australian Synchrotron pales in comparison.

Because other X-ray sources deliver their energy much slower than the XFEL, all previous observations had found that the X-rays randomly melt or destroy the crystal. The scientists had previously assumed that XFELs would do the same. The results, however, were not what they expected.

When the XFEL intensity was cranked up past a critical point, the electrons in the Buckyballs spontaneously rearranged their positions, changing the shape of the molecules completely. Every molecule in the crystal changed from being spherical, like a soccer ball, to being shaped like an AFL ball. This effect also altered the sample's optical and physical properties.

"We were stunned," said Associate Professor Harry Quiney, from the University of Melbourne. "This is the first time in the world that X-ray light has effectively created a new type of crystal phase."

"Though it only remains stable for a tiny fraction of a second, we observed that the sample's physical, optical and chemical characteristics changed dramatically from its original form."

"It was like smashing a walnut with a sledgehammer, and instead of destroying it and shattering it into a million pieces, we instead created a different shape — an almond!" added Associate Professor Brian Abbey, from La Trobe University.

The team's results have been published in the journal *Science Advances* and are said to be pushing the 100-year-old science of crystallography in "a new, exciting direction", according to Associate Professor Abbey.

"Currently, crystallography is the tool used by biologists and immunologists to probe the inner workings of proteins and molecules — the machines of life," he said. "Being able to see these structures in new ways will help us to understand interactions in the human body and may open new avenues for drug development."



Image credit: ARC Centre of Excellence for Advanced Molecular Imaging.





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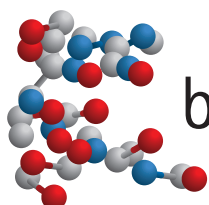
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## Tips on how to manage low endotoxin recovery

Lonza has announced a resource that addresses a key topic of debate in the endotoxin detection community — low endotoxin recovery (LER).

LER has been defined as the masking of endotoxin in undiluted biological drug products, such as monoclonal antibodies, vaccines and other protein products, and has been linked to the use of polysorbate in conjunction with a chelating buffer — specifically citrate and phosphate buffers. Lonza provides QC professionals with details on how to recognise LER in a process/product and what the limulus amoebocyte lysate (LAL) community is doing to help drug manufacturers who experience LER.

The archived webinar ‘Low Endotoxin Recovery (LER) — Context and Resolution from a Broad Biologics Test Perspective’ delivers the latest information and guidance about this phenomenon. ‘Low Endotoxin Recovery (LER) Frequently Asked Questions’ is meanwhile available as part of the company’s QC Insider Toolbox — an internet portal offering comprehensive support tools, training resources and a library of information that will help QC professionals achieve success in bacterial endotoxins testing.

“These LER resources in our QC Insider Toolbox — including the new Tech Tip sheet — not only provide guidance for the end user on the FDA’s current position on LER, but also include recommendations for performing hold-time studies and information on the use of naturally occurring endotoxin (NOE),” said Katrin Hoeck, head of marketing analysis and testing at Lonza Bioscience Solutions.

To access the webinar or sign up as a QC Insider, visit [www.lonza.com/qcinsider](http://www.lonza.com/qcinsider).



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## Tiny particles transformed into Lego-like building blocks

Melbourne researchers have developed a nanoscale engineering method that transforms tiny particles into Lego-like modular building blocks. Published in the journal *Nature Nanotechnology*, their work holds promise for micro- and nanoscale applications including drug delivery, chemical sensing and energy storage.

The work was led by Professor Frank Caruso at the University of Melbourne, who said his team nanoengineered building blocks to tailor the development of advanced materials. He explained, “Nano-objects are difficult to manipulate, as they’re too tiny to see directly by eye, far too small to hold and often have incompatible surfaces for assembling into ordered structures.

“Assembling Lego bricks into complex shapes is relatively easy, as Lego studs ensure the blocks stick together wherever you want.

“So we used a similar strategy as a basis for assembling nano-objects into complex architectures by first coating them with a universally adhesive material (a polyphenol) so that they resemble the studs on Lego bricks.

“This allows for a range of nano-objects to stick together around a template, where the template determines the final shape of the assembled structure.”

This simple and modular approach has been demonstrated for 15 representative materials to form different sizes, shapes, compositions and functionalities. Compositions include polymeric particles, metal oxide particles and wires, noble metal nanoparticles, coordination polymer nanowires, nanosheets and nanocubes, and biologicals.

“Many previous methods have been limited by particle-specific assembly,” Professor Caruso said.

“However, this new polyphenol-based particle approach can be adapted to different functions and allows different building blocks to be assembled into superstructures.” These superstructures include core-satellite, hollow, hierarchically organised supraparticles and macroscopic hybrid materials.

The ‘studs’ in the Lego brick-like structures, known as C/G studs from the polyphenols, provide a superstructuring process for assembling and interlocking the building blocks using multiple anchor points. The C/G studs on the building block nanoparticles can further interact with a secondary substrate and/or coordinate with metal ions, interlocking the structures. This provides a platform for the rapid generation of superstructured assemblies with enhanced chemical diversity and structural flexibility across a wide range of length scales, from nanometres to centimetres.



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## Peanut allergy treatment gets a \$15 million boost

Life sciences and technology venture capital firm OneVentures will lead a \$15 million funding round for a promising new treatment for peanut allergy in children, developed at the Murdoch Childrens Research Institute (MCRI). Unlike other treatments in development, the therapy will allow children with peanut allergy to incorporate peanut products into their diet.

The novel action, discovered and developed by MCRI's Professor Mimi Tang, is in the combination of peanut allergen together with a specific probiotic, *Lactobacillus rhamnosus*. It was tested in MCRI clinical trials starting in January 2015, which saw 62 peanut-allergic children given either the probiotic-peanut combination or a placebo over 18 months.

At the end of the study, 82% of children who received the probiotic-peanut therapy were able to tolerate up to 16 peanuts after the treatment had finished, compared with 4% of children who received a placebo. A further multicentre study is underway, across three Australian sites, to see if the therapy can produce a longer term tolerance of up to 12 weeks.

"Based on the results we have seen to date, if nine children were given probiotic and peanut therapy, seven would benefit," said Professor Tang. "This is a very promising result, and we look forward to seeing further evidence from the current trial and progressing the development of this approach so that all children with peanut allergy can access this treatment."

OneVentures will now invest \$8 million in Probiotic Therapies for Allergy (ProTA), the company established to commercialise the technology in peanut allergy, and explore other indications, with the approach holding the potential to treat allergies to milk, egg, shellfish and other nuts. The treatment is already attracting the attention of global pharmaceutical companies, and late-stage negotiations are underway to secure an additional \$7 million from strategic investors and partners of OneVentures.

"OneVentures will play an active role in bringing ProTA's treatment to market and assist with the management of clinical development and navigating the regulatory pathway, and bringing international partners to the table, as it has done with previous investments," said Dr Paul Kelly, managing partner of OneVentures.

## Fast-acting insulin from snail venom

Australian and US scientists have found that peptide molecules from the venom of a marine cone snail, common to northern Australia, contain an insulin-like natural protein called Con-Ins G1 that can operate more rapidly than human insulin.

The findings build on earlier studies which reported that the marine cone snail *Conus geographus* used an insulin-based venom to trap its prey. Unsuspecting fish prey would swim into the invisible trap and immediately become immobilised in a state of hypoglycaemic shock induced by the venom.

Now, the researchers have used the Australian Synchrotron to create and analyse the 3D structure of this cone snail venom insulin protein. Their results have been published in the journal *Nature Structural & Molecular Biology*.

"We found that cone snail venom insulins avoid the structural changes that human insulins undergo in order to function — they are essentially primed and ready to bind to their receptors," said Associate Professor Mike Lawrence from the Walter and Eliza Hall Institute, who added that human insulins could be considered 'clunky' by comparison.

"The structure of human insulins contain an extra 'hinge' component that has to open before any 'molecular handshake' or connection between insulin and receptor can take place," he said.

What's particularly exciting is the fact that Con-Ins G1 is able to bind to human insulin receptors. As explained by Dr Helena Safavi-Hemami from the University of Utah, Con-Ins G1 can 'switch on' human insulin cell signalling pathways, which could hold the key to developing ultrafast-acting insulins for more efficient diabetes management.

"Now we can look at the human insulin and see if we can make it more snail-like," she said.

The team's next step is to measure how quickly snail insulin, or a modified human insulin, would work when injected into an organism. Fish are affected almost instantly because the insulin passes over the gills. In humans, the process may take five minutes — though this would still be substantially faster than the 15–30 minutes required for the fastest-acting insulin currently available.

"It's really about learning from nature," concluded Danny Chou from the University of Utah.



The venomous *Conus geographus* hunting a fish.

Image courtesy of Baldomero Olivera, University of Utah.



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### Chemical-resistant disposable glove

Ansell has announced the Microflex 93-260, claimed to be the thinnest, chemical-resistant, single-use glove available on the market. The product offers tough protection against a broad range of chemicals while still providing the dexterity and tactility of a thin, disposable glove.

The thin, disposable glove is designed to offer higher levels of protection against chemicals for longer periods of time than ordinary single-use gloves. The glove achieves this through a three-layer design that resists a wide range of aggressive chemicals. The exterior nitrile layer delivers maximum protection against organic solvents, while the soft neoprene middle layer provides acid and base resistance. A final interior layer provides a continual dry feel, while also easing the donning and doffing process. The glove is just 7.8 mm thick, so it offers this protection while also providing enhanced tactility and dexterity for easy handling of small parts and tools.

The glove's thin design and chemical resistance make it suitable for a broad range of applications, including laboratory work, paint shop work, assembly and fabrication, and general maintenance and repair. It is also a good choice for aircraft engineers and maintenance workers, as it resists common hydraulic fluids used in the aerospace industry.

The glove is available in sizes XS to XXL (5.5-11) and features textured fingers and an extended cuff for added protection. In addition, the glove meets EN374-JKL, ASTM D 3577, EN 420 and EN 388 Abrasion Level 2 performance standards.

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### Sanitation verification system

Neogen has received approval from the AOAC Research Institute for its rapid AccuPoint Advanced ATP Sanitation Verification System. The approval follows a recent study by NSF International that showed the product exceeded the performance of competitive systems.

Adenosine triphosphate (ATP) sanitation monitoring systems are used extensively in the food industry to instantly assess the effectiveness of sanitation programs. The results in the AOAC validation report provide evidence that the Neogen system produces consistent data for evaluating sanitation program effectiveness in food processing and foodservice facilities.

AccuPoint Advanced is an enhanced version of the AccuPoint test system. Improvements include: improved sampler chemistry to produce more consistent results with even greater sensitivity; an enhanced instrument to produce faster results (less than 20 s); and advanced Data Manager software to easily streamline the testing process by creating test plans and syncing important data, while keeping a permanent record of sanitation test results.

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# Just add water

## On-demand pharmaceutical manufacturing



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US researchers have been working on a molecular manufacturing method that can produce a broad range of biomolecules anywhere in the world, without power or refrigeration. The result is a 'just add water' solution that affordably, rapidly and precisely generates compounds that could be administered as therapies or used in experiments and diagnostics.

“**T**he ability to synthesise and administer biomolecular compounds anywhere could undoubtedly shift the reach of medicine and science across the world,” said Dr James Collins, senior author on the study. The work was led by Dr Collins’ team at Harvard’s Wyss Institute for Biologically Inspired Engineering and has been published in the journal *Cell*.

‘Portable biomolecular manufacturing’, as the work has been dubbed by Dr Collins’ team, hinges on the idea that freeze-dried pellets containing ‘molecular machinery’ can be mixed and matched to achieve a wide variety of products. By simply adding water, this molecular machinery can be set in motion. The approach builds on work described in a 2014 paper where the team demonstrated that transcription and translation machinery could function in vitro, without being inside living cells, inside freeze-dried slips of ordinary paper embedded with synthetic gene networks.

The new method employs two types of freeze-dried pellets containing different kinds of components. The first kind of pellet contains the cell-free ‘machinery’ that will synthesise the end product. The second kind contains DNA instructions that will tell the ‘machinery’ what compound to manufacture. When the two types of pellets are combined and rehydrated with water, the biomolecular manufacturing process is triggered. The second type of pellet can be customised to produce a wide range of final products.

Compounds manufactured using the method could be administered in several ways to a patient, including via injection, oral doses or topical application. Furthermore, the technology is applicable to a wide variety of applications. For example, since antibodies are increasingly being used to treat microbial infections and diseases ranging from cancer to immune disorders, the researchers used their system to create a portable, modular toolbox for making designer antibodies against a variety of disease-relevant targets. This included one that could neutralise *C. difficile*.

bacteria, which cause fatal infections in people, and another that was able to target and kill breast cancer cells.

Since they are freeze-dried, the pellets are extremely stable and safe for long-term storage at room temperature for up to and potentially beyond one year. The method is also cheap to deploy at roughly \$0.03 per microlitre, making it about 10 times less expensive than its commercial counterpart, although the exact cost can vary depending on the molecules being manufactured.

The team envisions that the method could be suitable for remote clinics lacking an uninterrupted chain of cold refrigeration, which restricts their access to lifesaving doses of medicines. Dr Keith Pardee, a former Wyss research scientist who is currently an assistant professor at the University of Toronto, noted, "This approach could — with very little training — put therapeutics and diagnostic tools in the hands of clinicians working in remote areas without power."

The team are also optimistic about other potential uses of this technology, including futuristic applications for long-term medical treatment during space travel. They are currently



Image credit: Wyss Institute at Harvard University.

*The team envisions that the method's freeze-dried components could be carried in portable kits (such as the mock kit pictured here) for use in the field anywhere in the world.*

looking to adapt the platform so that it can be used in field work and educational applications, as well as to determine how the technology could be used for additional small-molecule production. Although

Dr Collins admits that scalability may be an issue with certain molecules that are not immediately amenable to the freeze-drying process, his team are discussing the next steps they can take.

## what's new

### 95% QE back-illuminated scientific CMOS camera

The Prime 95B Back Illuminated Scientific CMOS (sCMOS) camera by Photometrics features 95% quantum efficiency (QE), making it a suitable choice for low-light imaging techniques such as super-resolution microscopy (STORM, PALM), confocal imaging, single-molecule fluorescence and light sheet microscopy.

The device offers 95% QE and backside illumination (BSI) all in the one camera. It is said to maximise light collection and to outperform other EMCCD type cameras.

The product's sensor converts up to 95% of incident photons into a measurable signal. The back-illuminated sensor brings light into the pixel photodiode from behind, avoiding structures that reflect or absorb light.

With a large  $11 \times 11 \mu\text{m}$  pixel area, the camera is said to deliver over 300% more signal than other sCMOS cameras at 100x magnification. The extreme sensitivity not only allows fainter signals to be detected, it provides the flexibility to increase frame rates or turn down the excitation intensity to reduce cellular photodamage.

The camera captures images using the full microscope field of view at over 41 fps with 16-bit images and 82 fps with 12-bit images. The combination of extreme sensitivity, low 1.3 e<sup>-</sup> read noise and high frame rates positions the product as a leading scientific CMOS camera for low-light microscopy techniques.

Other key features include regulated air cooling to -10°C, single-cable connection rather than a dual camera link, large field of view, C Mount interface, multiple expose out triggering and SMART streaming.

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## Anti-inflammatory drug detection in dead vultures



UK researchers have used a Genevac miVac DNA concentrator for efficient sample preparation in a forensic method to detect residues of diclofenac in vultures and livestock animals. The use of the concentrator made it easier for the team to detect diclofenac — a non-steroidal anti-inflammatory drug (NSAID) — in the carcasses of long-dead animals.

Traditionally, livestock carcasses on the Indian subcontinent and in Africa have been left out by the millions for scavengers, particularly vultures, to consume. Several species of vultures that are the primary consumers of these carcasses face extinction, with residues from diclofenac in the carcasses implicated in the cause. Given that NSAIDs are registered worldwide for administration to livestock animals, it is critical to be able to monitor for their presence in the environment.

Most conventional methods of diclofenac detection still require extraction of the drug residues from the tissues of the dead vulture or livestock animal — samples which must be retrieved as soon as possible after death so they may still be in sufficiently good condition. But with some carcasses not found for days, weeks or months, researchers developed a GC-MS method that could detect residues in more long-lived keratinous matrices.

The method saw the researchers extract samples of hair, nails and feathers in methanol overnight, drying down the extracts and derivatising with N,O-Bis(trimethylsilyl)trifluoroacetamide with 1% trimethylchlorosilane (BSTFA 1% TMCS) and ethyl acetate prior to GC-MS analysis. Initially, extracted samples were evaporated to dryness at 40°C under a steady stream of nitrogen in a block heater.

However, this method was time-consuming and inconvenient. Samples prepared from methanolic solution (1–2 mL) took 45–60 min to dry down, while extracted samples often took several hours. Samples dried down at different rates within the heater, and reconstitution of samples containing a small residue of methanol resulted in incomplete derivatisation or reaction inversion. Due to these problems, the researchers developed a sample concentration methodology using a miVac DNA concentrator.

Using the DNA concentrator, the researchers were able to dry samples prepared from solution in 15 min, while extracted samples took up to 1 h. There were no incidents of partial or incomplete drying, eliminating anomalous results due to poor or incomplete derivatisation. In addition, as the miVac runs free from operator attention and requires no consumables, it is a suitable laboratory tool for use in areas where the supply chain of scientific materials may be weak.

At least 15,000 samples were dried down over the course of the method development and subsequent validation. The concentrator purchased for the research has been shipped to Nairobi, where it will be used in the chemical laboratory of the Jomo Kenyatta University of Agriculture & Technology (JKUAT). There, it will be routinely used in wildlife forensic investigations both to ascertain the cause of death of African vultures and to evaluate the presence or absence of diclofenac and NSAIDs of concern in the agricultural environment.

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## Peristaltic pumps

The UniSpense PRO and OmniSpense ELITE are smart dispensing pumps from Wheaton. The peristaltic pumps have been developed to facilitate precise performance and operation, thus minimising researchers' time and effort while achieving good sample handling.

The intelligent pumps are operated by an icon-driven interface on a 5" LCD screen that is chemical and glare resistant. Single-screen calibration walks the user through the process step by step. A high-precision stepper motor enables easy dispensing.

The pump's small footprint and overall size make it suitable for the crowded laboratory bench, while its low-profile design enables use in a fume hood or a biological safety cabinet. Built-in flexibility allows compatibility with different size tubing, pump heads and applications.

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## Argon gas cylinders

The ALbee Weld portable cylinders have been developed with plumbers, construction industry workers, auto repairers, mechanics and other arc-welding professionals in mind. Designed for efficiency and ease of use, the cylinders offer comfort, efficiency and practicality, be it for MIG welding aluminium, TIG welding stainless steel or performing any other arc-welding application.

The Weld Ar for TIG/MIG arc-welding applications and the Weld ArMix for MAG applications are available in 5 and 11 L 200 bar and 11 L 300 bar, with up to 3 h of arc-welding time. The gas cylinders also include the MINITOP head feature with on/off lever, flow-rate wheel, content gauge and easy end-user quick-connection.

The cylinders are straightforward to use, relieving the user of the need for rented gas cylinders. At each exchange, Air Liquide thoroughly checks and services the cylinder's MINITOP valve to ensure it is in proper working order.

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## Simultaneous thermal analysis

Simultaneous TGA-DTA/DSC measures both heat flow (differential scanning calorimetry) and weight changes (thermogravimetry). The Linseis STA Platinum Series (simultaneous thermal analysis) can be used to determine simultaneous changes of mass (TG) and caloric reactions (DSC) of a sample in the temperature range from -150 up to 2400°C. Product characteristics include high precision, high resolution and long-term drift stability.

The STA PT 1000 is a top-loading thermobalance with a user-friendly design. It enables automatic electronic tare of samples up to 10g and its furnace allows fast heating and cooling rates with precise temperature control. With the ability to be equipped for evolved gas analysis (EGA), the product is suitable for thermal composition, thermal stability and oxidation studies.

The STA PT 1600 offers high TG and DSC resolution, good vacuum capabilities and high TG drift stability. It is a modular system with exchangeable furnaces and different measuring systems and crucibles, plus optional accessories. The vacuum-tight design allows for static and dynamic atmospheres up to 1750°C. Its autosampling unit can be used for up to 64 sample positions with the sample robot. EGA can be enabled using integrated QMS, FTIR, GCMS or in situ EGA coupling options.

The STA PT 1600 High Speed is a combination of the STA PT 1600 and an additional inductive furnace for high-speed TG measurements, with a heating rate up to 100°C/s. The product provides TG combined with simultaneous DSC or DTA, as well as TG measurements with fast heating and cooling rates.

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## Rotary evaporator

The rotary evaporator Rotavapor R-300, from BUCHI, evaporates liquids for separation. The modular concept offers many options for upgrades and customisation (eg, hand lift/electrical, touch-screen controllers, 2 and 5 L bath, protection shield, various vessel types, etc). Several vacuum pumps and recirculation coolers complete the product family.

The I-300 and I-300 Pro are interfaces for the rotary evaporator. Both are fully automated process controllers of all system components attached to the rotary evaporator. The I-300 Pro offers the additional option of navigating the menu either by using the function buttons/pushwheel or the touch-screen functionality of the display, or both combined. The different modes (operating or processing) are visually separated through reversing the display colours.

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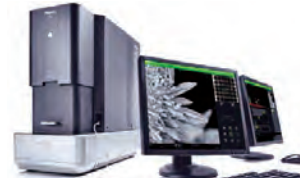
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### Vacuum mass comparator

The Mettler-Toledo M\_one is a suitable reference instrument for mass comparison under a controlled environment. The product is said to minimise all sources of uncertainty from the environment, the process and even itself during both measurement and transport, making it vital in the race to define the kilogram based on physical constants. It delivers results accurate to 0.1  $\mu\text{g}$  with typical repeatability of 0.3  $\mu\text{g}$ .

The race to redefine the kilogram involves two experiments: one using a Watt balance and the other using the Avogadro principle. To share and disseminate the investigated artefacts, each artefact must be transferred in a contamination-free atmosphere. Eliminating human error through automation, the M\_one vacuum pumping system enables the necessary controlled environment starting at ambient pressure and going down to a vacuum level of  $10^{-6}$  mbar.

Ergonomic design allows users to place weights directly onto the product's turntable through a large, quick-loading door. The system is sealed and allowed to reach desired atmospheric conditions. Once this pressurised environment is reached, the artefact is never exposed to air again. An Artefact Storage and Transport Vessel (ASTV), Artefact Transfer Device (ATD) and automatic Load Lock arm facilitate easy transfer of the artefact and preserve the pressure required to deliver necessary stability.

Once the artefact reaches the measurement chamber during comparisons, it is placed on a star-shaped weighing pan designed to accept various artefact shapes, such as cylindrical weights and silicon spheres from 100 g to 1 kg without adapter plates. Automated gravimetric centring (AGC) ensures correct positioning, minimising eccentricity and ensuring high repeatability.

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# The mystery of the dimming galaxy

## and the starving black hole



Main image: This wide-field image shows the sky around the faint active galaxy Markarian 1018. The galaxy itself is at the centre of the picture. Credit: ESO/Digitized Sky Survey 2. Acknowledgement: Davide De Martin. Inset: The active galaxy Markarian 1018, which has a supermassive black hole at its core. The faint loops of light around the galaxy are a result of its interaction and merger with another galaxy in the recent past. Credit: ESO/CARS survey

An international team of astronomers has discovered the secret behind a change in the behaviour of a supermassive black hole at the centre of a distant galaxy.

Utilising the European Southern Observatory's (ESO) Very Large Telescope, along with the Hubble Space Telescope and NASA's Chandra X-ray Observatory, the researchers suggested that the black hole is no longer being fed enough fuel to make its surroundings shine. Their work has been presented across two papers in the journal *Astronomy & Astrophysics*.

Many galaxies are found to have an extremely bright core powered by a supermassive black hole. They are thought to shine so brightly because hot material is glowing fiercely as it falls into the black hole, a process known as accretion. This brilliant light can vary hugely between different active galaxies, so astronomers classify them into several types based on the properties of the light they emit.

Some of the galaxies have been observed to change dramatically over the course of a decade or two. This was the case with the subject of this latest study, Markarian 1018, which changed from

a dim 'type 1.9' galaxy during its initial observation in 1974 to a bright 'type 1' galaxy in 1984. However, the galaxy's optical continuum brightness dropped by an order of magnitude between 2010 and early 2016, causing it to revert back to its initial classification.

"We were stunned to see such a rare and dramatic change in Markarian 1018," said Rebecca McElroy from the University of Sydney and the ARC Centre of Excellence for All Sky Astrophysics (CAASTRO), whose team were conducting routine observations of the galaxy with the Multi-Unit Spectroscopic Explorer (MUSE) installed on ESO's Very Large Telescope when they noticed the surprising change in the light output.

"We were lucky that we detected the event just 3–4 years after the decline started, so we could begin monitoring campaigns to study details of the accretion physics of active galaxies that cannot be studied otherwise," added Bernd Husemann, project leader of the Close AGN Reference Survey (CARS).

The research team made it their first priority to pinpoint the process causing Markarian 1018's

brightness to change so wildly, which could have been caused by any one of a number of astrophysical events. After being allowed use of the Hubble Space Telescope and the Chandra X-ray Observatory, they were able to solve the mystery — the black hole at the centre of the galaxy was being starved of accretion material.

"It's possible that this starvation is because the inflow of fuel is being disrupted," said McElroy. "An intriguing possibility is that this could be due to interactions with a second supermassive black hole." Such a black hole binary system is a distinct possibility in Markarian 1018, as the galaxy is the product of a major merger of two galaxies — each of which likely contained a supermassive black hole in its centre.

Since the initial discovery of Markarian 1018's dimming in 2015, the team has been able to confirm the galaxy's brightness is further decreasing. According to Husemann, future research will allow the researchers to further explore the world of starving black holes and changing galaxies in more detail.



## Refrigerated incubators

Thermo Scientific Heratherm refrigerated incubators provide a consistent temperature environment for incubation applications from 5–70°C, with enhanced accuracy in the range of 15–25°C. The instrument's easy-to-use interface can store up to 10 temperature protocols set by the user, with up to 10 steps in each, and includes a timer function, an automatic temperature alarm and adjustable overtemperature protection.

The refrigerated incubators employ Peltier technology, which circumvents the need for a refrigerant by using a thermoelectric element to cool or heat in one module, as needed. This element leverages the Peltier effect, where an electric voltage is converted into heat difference.

In addition to using insulation that is free of chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs), the refrigerated incubators consume little energy. Tests against predecessor compressor-cooled models are said to show up to 84% energy savings, making the system a suitable solution for many labs.

The incubator comes in two sizes: a 178 L benchtop model and a 381 L floor model for use in a variety of applications, including microbiology/fungi/yeast studies, reagent and antibody storage, and shelf-life testing.

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## PAL SPME fibres

Solid-phase microextraction (SPME) automated sample preparation reduces sample handling and solvent consumption. It has many applications in environmental, food, clinical and other industries. Restek PAL SPME fibres are high-performing fibres that are claimed to meet or exceed the performance of other brands.

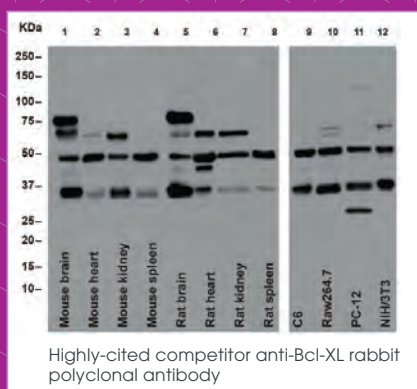
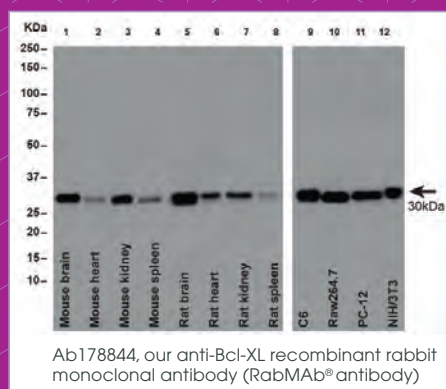
The SPME fibres feature an aluminium hub that is more durable than plastic. The fibres are optimised for PAL system autosamplers and are compatible with most GC inlets. They are suitable for a wide range of analyte chemistries and sample matrices.

The company's SPME product line is continually expanding and currently includes SPME fibres for both polar and non-polar target analytes across a wide range of molecular weights and volatilities.

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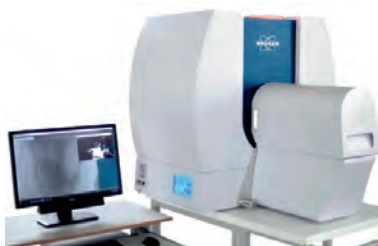


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The device is said to be the first in vivo microCT system with rapid helical scanning and InstaRecon technology to reconstruct images up to 8000 x 8000 pixels per slice. Researchers will also benefit from easy system control by a user-friendly touch screen and the ability to view and share images on any iOS or Android mobile device.

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### Dual independent-channel syringe pump

The Harvard Apparatus Pump 33 DDS (Dual Drive System) is a syringe pump featuring two independent pumping channels controlled by an intuitive touch-screen interface. It can run two separate flows using different directions, flow rates, volumes and syringe sizes.

The multipurpose pump employs mechanisms that include a tight-gripping, secure syringe clamp that accommodates syringe sizes 0.5  $\mu\text{L}$  to 60 mL. It features integrated syringe manufacturer tables and USB, RS232 and TTL connectivity.

The pump offers high accuracy ( $\pm 0.25\%$ ) and smooth flow from 1.02 pL/min to 106 mL/min. It employs a graphical user interface controlled with a large 7" LCD colour touch screen.

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# How much Neanderthal DNA is in modern humans?

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As *Homo sapiens* migrated out of Africa, tens of thousands of years ago, many members of the species interbred with Neanderthals and Denisovans along the way. But what sort of effect has this interbreeding had on the DNA of modern humans? Two different groups of US researchers decided to find out.

Studies have already shown that non-African individuals inherit about 2% of their genomes from Neanderthals, while people of Melanesian ancestry inherit another 2–4% of their genomes from Denisovan ancestors. But until now, it hasn't been clear what influence those DNA sequences have had on our biology, traits and evolutionary history.

Scientists from the University of Washington (UW) conducted a study using genome-scale maps of Neanderthal and Denisovan sequences identified in more than 1500 geographically diverse people. While the vast majority of surviving Neanderthal and Denisovan sequences were found at relatively low frequencies (less than 5%), the analyses turned up 126 places in our genomes where these sequences

exist at much higher frequencies, reaching up to about 65%.

The researchers' study, published in the journal *Current Biology*, finds that the genes humans inherited from Neanderthals or Denisovans are important for our interactions with the environment. For example, Neanderthal and Denisovan sequences were found in seven parts of the genome known to play a role in the characteristics of our skin.

"The ability to increase to such high population frequencies was most likely facilitated because these sequences were advantageous," said study co-author Joshua Akey. "In addition, many of the high-frequency sequences span genes involved in the immune system, which is a frequent target of adaptive evolution.

"Our work shows that hybridisation was not just some curious side note to human history, but had important consequences and contributed

to our ancestors' ability to adapt to different environments as they dispersed throughout the world," Akey stated.

But while hybridisation apparently enabled humans to hold on to useful genetic material, geneticists from the University of California, Davis say the vast majority of this material was lost from the modern human population due to natural selection.

In an attempt to understand the causes of this loss, study leader Ivan Juric and his colleagues developed a method for estimating the average strength of natural selection against Neanderthal genetic material. The researchers found that natural selection removed many Neanderthal alleles from the genome that might have had mildly negative effects.

"Our results are compatible with a scenario where the Neanderthal genome accumulated many weakly deleterious variants, because selection was not effective in the small Neanderthal populations," said Juric. "It is likely that these gene variations were able to persist in Neanderthals because Neanderthals had a much smaller population size than humans. Once transferred into the human genome, however, these alleles became subject to

"Our work shows that hybridisation was not just some curious side note to human history, but had important consequences"

natural selection, which was more effective in the larger human populations and has removed these gene variants over time.

"Selection is more efficient at removing deleterious variants in large populations," Juric elaborated. "Therefore, a weakly deleterious variant that could persist in Neanderthals could not persist in humans."

Published in the journal *PLOS Genetics*, the study sheds new light on the role of population size on losing or maintaining Neanderthal ancestry in humans. It also confirms previous reports that East Asian people had somewhat higher initial levels of Neanderthal ancestry than Europeans.

However, Juric admitted that the researchers "cannot conclude that differences in demography explain everything".

"For instance, genes that were deleterious only in human–Neanderthal hybrids might have existed, and sexual selection or other forms of selection against hybrids could have been very important processes during human–Neanderthal hybridisation," he said. "Still, I find it fascinating to think that if the Neanderthals had reached larger population sizes in Europe, or if modern human populations had grown slower, some of us today would probably carry a lot more Neanderthal ancestry in our genome."

## what's new

### 3D brain reconstructions

Used in applications in neuroscience research, MBF Bioscience's BrainMaker generates high-resolution 3D reconstructions from serial sections imaged with whole slide scanners and research microscopes.

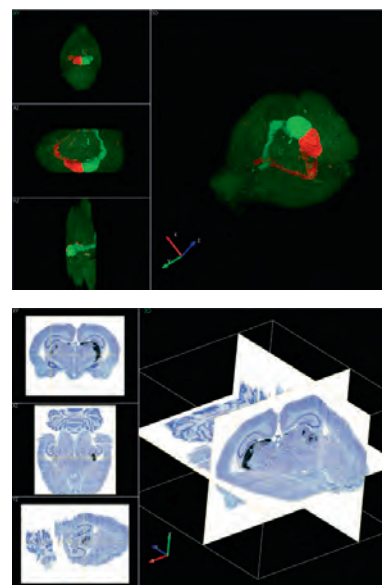
The images are loaded into the product, which automatically detects the individual sections on each slide and then aligns the sections to create the full 3D image reconstruction of the entire brain (or any organ). At a single glance the user can see the location of all neurons expressing a particular gene, visualising axonal projections of specific neurons within the full anatomical context.

If the user mounts a section upside down, BrainMaker will automatically correct it during the alignment process. The device uses innovative computational algorithms to align image features found in multiple serial sections. If additional adjustments need to be made to the automatic alignment, researchers can easily edit the 3D reconstruction.

The product allows the user to analyse the size and shape of neurons within the 3D reconstruction using Neurolucida 360 or analyse the number of neurons or the volume of a lesion with Stereo Investigator. Reconstructions can be stored, viewed and shared with Biolumica, MBF's platform for organising and sharing big image data.

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### Pipette tips

Generic pipette tips on a multichannel pipette can sometimes be misaligned. This is due to the widespread generic tip cone and tip fitting design as well as in the memory effect of the tip material, which gradually moves back to its original, non-stretched shape. Pipette tips that aren't level on a multichannel pipette can cause issues such as different immersion depths or faulty touch offs of individual tips, leading to negatively impacted pipetting results.

INTEGRA GripTips feature a positive stop, achieved by a shoulder moulded into all GripTips plus a corresponding tip fitting found on all INTEGRA EVOLVE, VIAFLO II, VOYAGER and VIAFLO 96/384 pipettes. This design ensures that pipette tips cannot be loaded beyond the positive stop and all tips will be at exactly the same height, thus improving the reproducibility of pipetting results.

Featuring a low attachment force and a low ejection force, the tips effortlessly snap onto the tip fittings and are easily ejected. No 'hammering on' technique is required and the tips will not loosen, leak or fall off.

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### C-mount microscope camera

Nikon's DS-Fi3 is a high-definition colour microscope camera. Its high-speed data readout, good colour reproduction and high quantum efficiency are optimal for imaging in various applications, such as brightfield, DIC, phase contrast and fluorescence observation.

The camera is equipped with a 5.9 MP CMOS image sensor, which enables the capture of high-definition images of up to 2880 x 2048 pixels. With high-speed data transfer via USB 3.0, the product enables fast focusing — even in high-resolution imaging — and efficient image acquisition when using a wide range of illumination techniques.

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# Leukaemia cells run but don't hide

An Anglo-Australian team of researchers has pioneered a new method of zooming in on leukaemia cells in action and found that the notoriously treatment-resistant blood cancer cells are not playing 'hide and seek', as was traditionally believed, but are actually playing a game of 'tag'.

**A**dult leukaemia patients typically suffer a 50% relapse rate after initial chemotherapy. Subsequent treatments tend to be less effective, resulting in a fatal spreading of the cancer. An international team of researchers, led by Dr Edwin Hawkins from Melbourne's Walter and Eliza Hall Institute of Medical Research (WEHI), has determined that the long-held hypothesis of acute lymphoblastic leukaemia (ALL) cells hibernating in bone marrow to avoid cancer treatments is inaccurate.

In collaboration with Dr Cristina Lo Celso from Imperial College London, Dr Hawkins' team found that the cancerous cells which evade chemotherapy are not hiding or hibernating but running away.

"We realised that instead of playing hide and seek with the chemotherapy, as was initially thought, the treatment-resistant ALL cells were engaging in a 'catch me if you can' game of tag,"

Dr Hawkins said. "Right before our eyes, these cells were sprinting off in all directions: dividing, jumping in and out of blood vessels and using such 'highways' in the body to migrate and recolonise."

Pioneering a high-resolution technique likened to a cellular equivalent of CCTV, the team were able to create 'optical windows' allowing them to zoom in to the level of a single micron. Previous analysis only gave researchers static snapshots at this level of magnification, but the new system is closer to a video feed of cellular-level activity.

Dr Hawkins said, "Our new technique allows us to watch action unfolding for days, with the ability to zoom in and out on the same patch of tissue: from 3.5 x 2.5 mm, right down to a single micron — it's incredible."

This dynamic new perspective will lead to a paradigm shift in tailoring treatments for ALL patients. Dr Hawkins said, "We now know that it is ineffective to design treatments to target the surrounding stromal cells or 'hiding places' of the cancer, because the cells are not hiding."

Another benefit of being able to observe cancer cells in action at this level is developing new pain treatments. Co-author Dr Delfim Duarte of Imperial College London said, "We also discovered that pain experienced by many leukaemia patients is caused by cells stripping and destroying tissue lining the bone, rather than overcrowding and causing pressure."

Dr Hawkins is confident that this new discovery will revolutionise the way this particular form of cancer is treated. He said, "To beat leukaemia, we must develop a treatment that targets the ability of the cells themselves to 'run' around the body. We are now working on finding a way to stop these cells in their tracks and win the game of tag."

Published in *Nature*, this research was funded by the European Hematology Association, the Human Frontier Science Program, the European Research Council, Cancer Research UK, Bloodwise and Australia's National Health and Medical Research Council (NHMRC).





### Total PSA (human) ELISA kit

Prostate-specific antigen (PSA), also known as  $\alpha$ -seminoprotein or kallikrein-3 (KLK3), is a kallikrein-like protease produced by the epithelial cells in the prostate gland, the lining of the urethra and the bulbourethral gland. The Total PSA ELISA kit, from Enzo Life Sciences, enables the detection of total PSA in human serum, plasma, urine and tissue culture media samples in just 2.5 h for up to 40 samples in duplicate.

The assay provides an equal molar detection on different forms of PSA in human matrices, which is said to improve the accuracy and sensitivity of the measurement on the total PSA levels. It can detect as little as 0.287 pM (or 0.024 ng/mL), with negligible cross reactivity with similar proteins (KLK2, ACT). It provides fully quantitative results that are said to surpass semi-quantitative Western blot analysis.

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### Imaging system



The ImageXpress Micro 4 High-Content Imaging System, from Molecular Devices, has an agile design that allows users to boost their research. The system is said to be faster than ever, while also providing the option to upgrade to confocal in the future to align with users' research needs.

Users can capture images of whole organism and cellular or intracellular events, with the system configured to suit their specific biological needs. Molecular Devices offers unlimited configurability with user-exchangeable filter cubes, a wide range of objective lenses and environmental control, transmitted light, confocal imaging and fluidics options.

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## Instruments for studying biosurface interactions



Q-Sense instruments enable the study of molecular binding and interactions with surfaces using the principle of quartz crystal microbalance with dissipation (QCM-D). The systems offer

real-time, label-free measurement of the mass of thin films with nanogram sensitivity and simultaneously provide novel insights about their structure.

Q-Sense Dfind is easy-to-use software for analysing QCM-D data which complements the latest product family and includes the Q-Sense Pro, Q-Sense Analyzer, Q-Sense Explorer and Q-Sense Initiator. Q-Sense Initiator is for those interested in real-time monitoring of surface interactions but only need the basic functions of a QCM-D instrument. Graphene oxide (GO) is now included in the long list of coating materials in the Q-Sense product range.

Applications include adsorption and desorption kinetics, film thickness and level of hydration, protein aggregation and conformational changes upon binding of a ligand or cross-linker. Interactions can be studied on substrates such as gold, metals, polymers and functionalised coatings. The measurement chamber is available in single- and four-channel versions and can be combined with techniques such as electrochemistry, ellipsometry and microscopy.

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## Cell culture vessel

The Greiner Bio-One CELLdisc is a ready-to-use, multilayer system for large-scale and industrial propagation of adherent mammalian cells. Using a robust, pressure-resistant cylindrical design, cultures are maintained for maximum growth area using a minimum of space.

The screw cap opening allows for easy filling and a gas support channel and vent port allow for pressure equalisation. A wide, interconnecting channel facilitates fast liquid exchange and uniform distribution of gas throughout the unit. In addition, a protective base rim guarantees that the bottom layer of the CELLdisc does not touch the surface of the incubator.

The four-layer version has a growth area of 1000 cm<sup>2</sup>, the eight-layer unit has a growth area of 2000 cm<sup>2</sup>, the 16-layer unit has a growth area of 4000 cm<sup>2</sup> and the 40-layer version has a growth area of 10,000 cm<sup>2</sup>. Units are available with standard or advanced tissue culture treatments.

**Interpath Services Pty Ltd**

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## Mini DC electric linear actuator

maxon motor has released a completely customised miniature electric linear actuator for positioning tasks. By combining a 16 mm, 60 W, 24 V brushless DC motor with an integrated radial and axial thrust block bearing system, the shaft is manufactured directly as a ball screw assembly.

Despite the tiny dimensions available, with motor diameters as low as 6 mm, the units can deliver high linear forces. The 16 mm ball screw version has a force delivery capability of 403 N. With the brushless motor's ability to accelerate to 12,000 rpm in under 2 ms, the actuator is also dynamic.

The motor is fitted with an integrated digital encoder for detent-free smooth positioning. The length of the ball screw and the nut details are configurable to suit the machine design requirements.

**maxon motor Australia Pty Ltd**

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### Crossflow filter

Sartorius Stedim Biotech has announced the small-scale Sartocon Slice 50 ECO crossflow device. The crossflow filter has been specially designed for water-based protein solutions with viscosities below 3 cp.

The crossflow cassette can typically be used in biotech applications, such as filtration of IgG, blood factors and peptides, especially involving membrane screening and small-volume process development. The reduced flow channel geometry lowers the recirculation pump requirements by as much as 50% versus a standard design.

Only half of the pump energy is needed, decreasing the shear stress on all protein solutions.

The device is offered as an encapsulated and ready-to-use crossflow module. Offered in a wide selection of molecular weight cut-offs, it has a filter area of 50 cm<sup>2</sup>. The cGMP-validated self-contained filtration unit eliminates the need for a compression holder and is available in a choice of two polymers.

The first polymer, a stable polyethersulfone membrane (PESU), is suitable for a broad pH and temperature range. The second polymer, the Hydrosart membrane, is a stable, cross-linked regenerated 'cellulosic' polymer. It is also suitable for a broad pH range and can be cleaned and depyrogenated using up to 1 N NaOH at elevated temperatures. This membrane is hydrophilic, making it non-protein-binding and virtually non-fouling. It is easy to clean and delivers high product flux and product yield.

Benefits of the Sartocon Slice 50 cassette include its scalability and identical materials of construction. These properties ease transfer of process development results to the next scale-up level. In addition, the filter device can be readily interfaced with the company's benchtop crossflow system SARTOFLOW Smart and with many other laboratory-scale filtration systems.

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# We could grow jet fuel on gum trees

— if there's anywhere left to plant them



Scientists are one step closer to using Australia's iconic gum trees to develop low-carbon renewable jet and missile fuel. The only problem is, the habitat of more than 90% of eucalypt species is set to decline in the near future due to climate change.

**R**esearchers from The Australian National University (ANU) participated in an international study which set out to find an alternative to fossil fuels for the aviation industry. As explained by Dr Carsten Kulheim, powering a modern jet aircraft with anything other than fossil fuels is difficult due to the high energy required.

"Renewable ethanol and biodiesel might be okay for the family SUV, but they just don't have

a high enough energy density to be used in the aviation industry," he said.

The good news, said Dr Kulheim, is that eucalyptus oil contains compounds called monoterpenes, which can be refined through a catalytic process and converted into a very high-energy fuel. Co-researcher David Kainer added that jet fuel derived from eucalyptus oils would be close to carbon neutral, saying, it would have "minimal ecological impact".

"We can plant these trees on marginal lands that have low rainfall, and we can also plant them in agricultural systems that have salinity problems and help them defeat that problem," he said.





Researchers from the University of Melbourne, Dr Laura Pollock and Dr Heini Kujala, used over 260,000 geospatial data points from eucalypt specimens stored in Australia herbaria and accessed through Australia's Virtual Herbarium. This information was used to create models of current locations and preferred environmental conditions for 657 species of eucalypt trees.

"Once we had developed the models, we could then determine which areas in Australia would be climatically suitable for the species in the future, as the climate changes," Dr Kujala said.

Associate Professor Bernd Gruber, of the University of Canberra, said a 3°C temperature rise over the next 60 years will see a decline of suitable habitat for 91% of the 657 species of eucalypts studied.

"As a consequence, the distribution of many species will change, and we expect trees suited to temperate and southern Australia to be hit particularly hard, contracting to more climatically suitable areas further south or at higher elevations," he said.

The research found that rare, evolutionarily ancient trees which have existed for a long time will feel the brunt of climate change, with Associate Professor Gruber saying, "At least 16 species would have suitable climatic zones disappear altogether."

"Our analysis suggests that only 9% of eucalypt species have the potential to increase their distribution over the same time period."

Associate Professor Gruber said the study "demonstrates the importance of not simply counting the number of species in biodiversity conservation, but also considering their evolutionary history, which determines how closely related species are to each other".

"Using this approach we were able to identify hotspots that will contain high levels of eucalypt diversity under a changing climate, both in terms of the number of species and their reflection of the trees' evolutionary pathways. Protecting these hotspots will be important to ensure we retain biodiversity in the future," he said.

Writing in the journal *Trends in Biotechnology*, the researchers examined how to boost production of monoterpenes to obtain industrial scales of jet fuel from plants. This includes selecting appropriate species, genetic analysis, advanced molecular breeding, genetic engineering and improvements to harvesting/processing of the oils.

"We're looking for species that have the right type of oil and in addition to that, since the oil is in the leaves, they need to grow a lot of leaves in a short amount of time," said Kainer.

"Eucalyptus plantations globally produce up to 200 kg of oil per hectare per year, but

by selecting the best genetic stock they could produce more than 500 kg of oil per hectare."

"If we could plant 20 million hectares of eucalyptus species worldwide, which is currently the same amount that is planted for pulp and paper, we would be able to produce enough jet fuel for 5% of the aviation industry," Dr Kulheim added.

There's just one hitch in the plan — a separate international study, published in the journal *Nature Climate Change*, has found that Australians could see fewer suitable environments for the country's iconic eucalypt trees within a generation, with 16 species forecast to lose their home environments entirely within 60 years.

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## Surface plasmon resonance system

Biacore 8K is an eight-needle, high-sensitivity surface plasmon resonance (SPR) system from GE Healthcare's Life Sciences business. It offers high-quality kinetics and affinity data at a speed that is said to shorten time to results by up to eight times compared to single-needle systems.

Its flexibility facilitates the analysis of small fragments through to multidomain proteins as well as drug formats such as bispecific antibodies. Its sensitivity and stability generate high-quality binding data for small molecules binding to complex targets such as GPCRs, and provides an alternative to traditional immunoassays such as ELISAs.

Eight needles allow the analysis of up to 2300 small-molecule fragments in a day and the novel 2D kinetics methodology delivers full kinetic characterisation data within 35 min, without the need for extensive assay development. Affinity and kinetic ranking enables rapid selection of biotherapeutic or small-molecule hits, while detailed kinetic and affinity data help to characterise and optimise selected binders.

Additionally, the system can generate high-quality kinetic characterisation of 64 interactions in 5 h and the ability to analyse samples in crude matrices, reducing the need for sample preparation. Coupled with intuitive software, the product provides quick interaction analysis for users at all levels of experience.

For more information: <http://www.gelifesciences.com/biacore8K>.

**GE Healthcare Australia Pty Ltd**  
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## Nitrogen gas generator system

Peak Scientific has announced the launch of the Solaris benchtop nitrogen gas generator system. The product provides a compact and convenient gas source for labs using ELSD (evaporative light scattering detector) instruments and compact mass spectrometers, which typically require lower flow rates and specific purity.

With variable purity in relation to outlet flow and pressure, the device is a flexible solution for supplying nitrogen to one or two ELSD instruments, or a single compact mass spec, capable of delivering up to 10 L/min and at purity levels of up to 99.5% (at lower flow rates). Available with an optional dedicated air compressor module, it shares a similar design to Peak's modular Precision series (for GC applications), as the generator can be stacked on top of the compressor. Its stylish fascia also functions as a status indicator as its colour indicative LED light alerts the user when the instrument reaches optimum purity and flow for analysis.

The product gives the user a consistent on-demand flow of nitrogen gas and brings efficiency to labs by removing the inconvenience of cylinder changeovers. It also removes the safety concerns of storing large volumes of gas on-site. It is engineered, assembled and performance tested at Peak's ISO 9001 accredited manufacturing centre in the UK and is backed by the company's global on-site technical support.

**Peak Scientific Instruments Pty Ltd**  
[www.peakscientific.com](http://www.peakscientific.com)





## Liquid handling system

Tecan makes it quick and easy for manufacturers to develop instruments for liquid handling applications. The Cavro Omni Flex extends the flexibility and convenience of the company's Cavro Omni Robot by offering more hardware



options to complement its precision pipetting, including frames, worktables, power and input/output management, racks and all the pumps and other options required to perform liquid handling tasks.

The company has designed the product to simplify prototyping, method development and regulatory approval. The modular system allows virtually any combination of axes, pipetting modules, pumps and worktable options, with a wide range of additional options — such as skins, shields, sensors, locks and carriers — to suit the needs of individual instrument designs and applications.

Using UL-recognised components and developed with RoHS and FDA criteria in mind, the unit is designed to streamline and simplify regulatory approval for laboratory and diagnostic instrumentation. This ensures peace of mind and trouble-free operation to match the user's application needs.

**Tecan Australia**

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

## Screening plate

The MDR/MRGN Screening 2 plate is now available with the antimicrobial agents ceftolozane/tazobactam and ceftazidime/avibactam. Merlin has adapted the layout of the plate according to the latest EUCAST recommendations.

The Meropenem screen was configured for a more sensitive detection of low-level carbapenem resistance in enterobacteria. Furthermore, the antimicrobial agents ceftolozane/tazobactam and ceftazidime/avibactam were configured.

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## Pipette calibration

Pipettes and dispensing systems are required to be checked and calibrated on a regular basis. Pipetto provides users with the ability to check their devices in precision and repeatability, as well as tracking and documenting device quality.

The product enables users to calibrate their pipettes, dispensers, burettes and automated pipetting devices in an easy, fast, intuitive and precise way. Measurement is possible using all known standards (DIN, ISO, ASTM, British Standard, Australian Standard and more). The unit is network capable and Microsoft certified.

The device may be connected to the user's own balance and used within current calibration procedures. It stores all data and calibration measurements and features built-in assistance using online help, a calibration wizard and a user manual. Real-time compensa-

tion for environmental conditions is possible using the PCom Climate Module.

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## Device for thermometric titrations

Metrohm provides the 859 Titrotherm with tiamo software for thermometric titrations — a device that can easily be automated by integrating an autosampler. The product is suitable for quantifying sodium in foodstuffs, serving as an alternative to determining the counterion chloride using argentometric titration.

Thermometric titration shares with potentiometric titration the use of a sensor to detect the endpoint of the titration reaction. In the case of thermometric titration, however, the sensor is a fast-responding thermometer. Instead of measuring the electrochemical potential in the solution, the robust, sensitive thermometer tracks the reaction enthalpy, ie, the temperature change in the solution.

The endpoint of the titration is marked precisely by the moment, when the reaction stops and no significant temperature change is registered any longer in the solution. Because it relies merely on a change of solution temperature to find the endpoint, there is no need to calibrate the sensor. Sensor maintenance is minimal and it can be stored dry between titrations.

As for sample preparation, users only need to ensure that the matrix does not prevent the analyte from reacting with the titrant and that the sample is sufficiently mobile. Results are available in less than 2 min.

**MEP Instruments Pty Ltd**

[www.mep.net.au](http://www.mep.net.au)



## Analytical cytometer

Bio-Rad Laboratories, in partnership with Propel Labs, offers the ZE5 Cell Analyzer. Designed with core lab input, the ZE5 (formerly YETI through Propel Labs) is an easy-to-use, high-performance analytical cytometer that will enable users to perform both basic and multiparameter cytometry for a wide range of applications.

The instrument is built around an integrated plate loader with features such as Real Time Addition of Reagents — enabling real-time assays and eliminating pipetting errors, Integrated Active Temperature Control and more. It is configurable with 2–5 lasers and up to 28 colours, with side scatter and dual forward-scatter detectors that allows FSC detection while simultaneously collecting small-particle or alternate-wavelength scatter data.

The product is an integrated, high-throughput instrument. It maintains sample integrity, provides flexibility and helps streamline the user's flow cytometry workflow.

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## Cryotube

Traditional external-thread cryotubes allow only 9 x 9 storage in standard cryoboxes. TENAK's latest cryotube allows users to increase their cryotube storage capacity by 23%.

The SlimTube is only 12 mm in diameter, allowing the storage of 100 tubes in a 10 x 10 array in a standard cryobox while retaining the external thread to ensure no sample contamination. By adding 23% more samples into a freezer, the cost per sample is reduced by up to 20%.

The tube and cap are made from specially formulated medical-grade polypropylene, with equal coefficient of expansion for a secure seal from bench down to cryogenic temperatures. The cap's steep thread allows a half-turn opening and the star-foot base ensures the tube is self-standing and compatible with standard workstations for single-handed operation.

There are two level indicators to show appropriate filling levels for -80°C and -196°C storage to improve safety and reduce the risk of overfilling the tubes. The tube has a white-printed write-on labelling area for manual identification.

SlimTubes are supplied in self-standing resealable bags of 100 tubes and are free of DNA, DNase, RNA, RNase and ATP. They are available in five sizes — 0.5, 1, 2, 4 and 5 mL — and three double-sided cap inserts (with two colours each, making a total of six colours) aid sample identification.

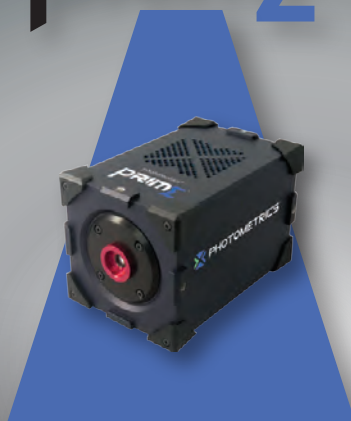
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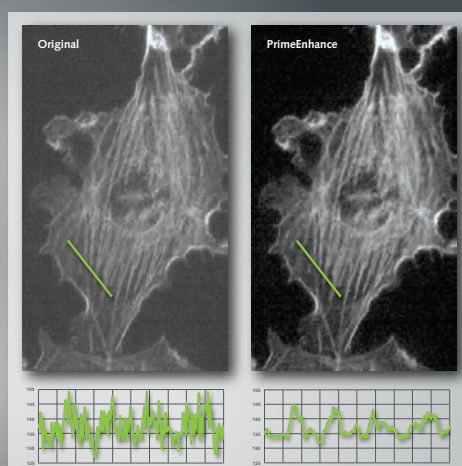
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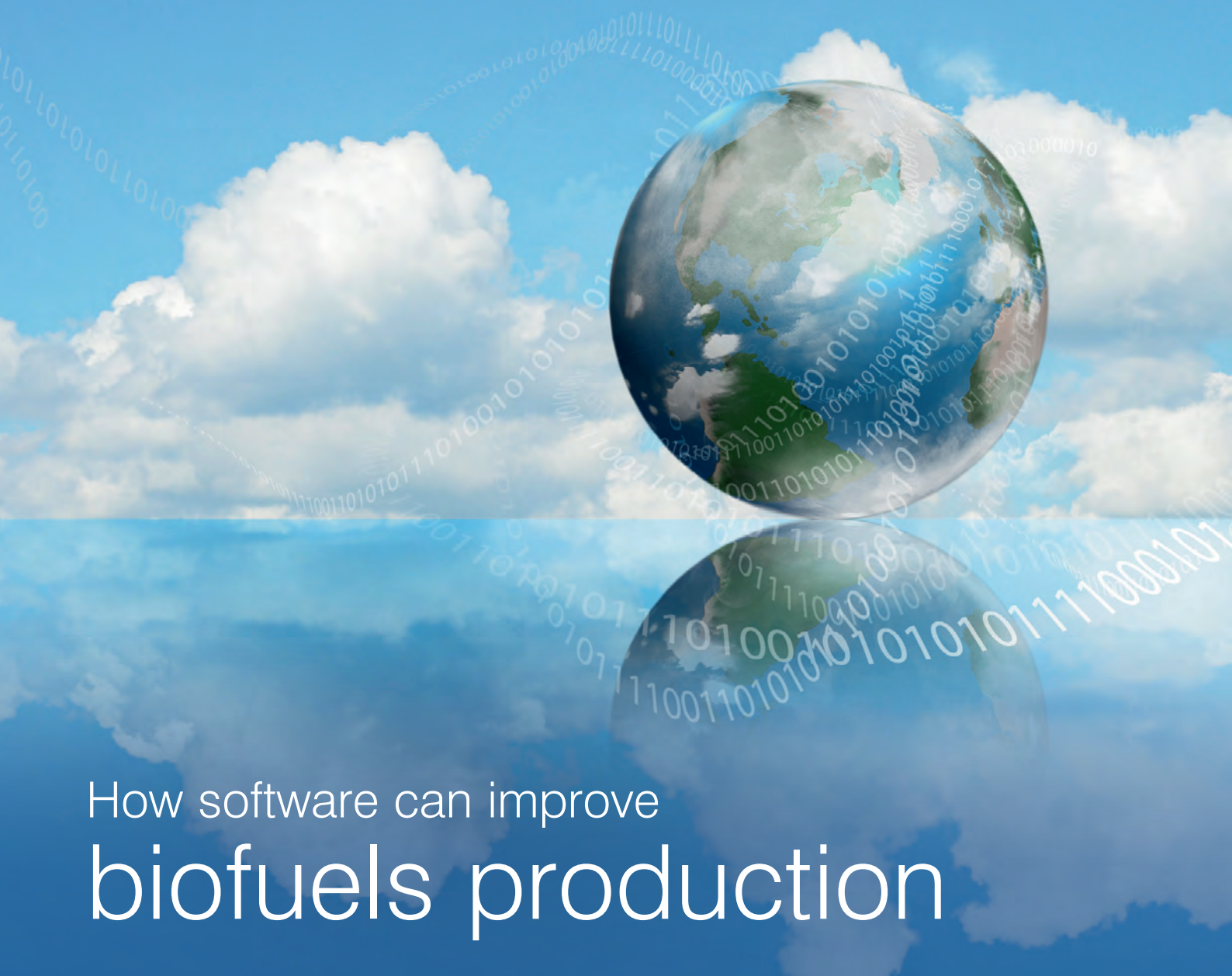
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# How software can improve biofuels production

First it was United Airlines announcing plans to phase in biofuels in all flights operating out of LAX. Then KLM Royal Dutch actually launched flights from Oslo to Amsterdam using biofuels to power an Embraer 190.

**T**his may be a drop in the bucket for an industry that now exceeds \$700bn in yearly revenue, but it's clearly a sign of what's to come. It's also proof that biofuels production is rapidly maturing, and this will dramatically increase expectations for quality and volume industry-wide. As this happens, biofuels lab will be under increased pressure to deliver quickly, efficiently and cost-effectively.

To meet the increasing industry demand, producers will certainly step up production on entirely different scales. As this happens, opportunities for pernicious inefficiencies and outright failures increase exponentially. Fortunately, advanced analytical technologies

and software can help producers reliably monitor, analyse, report and manage production.

## New technologies demand new approaches

From gas chromatography (GC), ion chromatography and Fourier transform infrared (FTIR) spectroscopy to inductively coupled plasma mass spectrometry (ICP-MS), labs are increasingly outfitted with highly sensitive instruments capable of unprecedented throughput. But all of this, while critical to managing profitable production, creates data on a never-before-seen scale, and all of it must be traceable.

The management and effective use of data can be daunting. From routine analysis to complex pattern recognition and reporting, mistakes with data can compound rapidly. As production accelerates, managing data, with a laboratory information management system (LIMS) for

example, will be as important to scalability and profitably as any piece of capital equipment used for production. The stakes are high.

### Data must not exist in isolation

For efficient and profitable production, data related to any process or transaction cannot exist in isolation. Many leading biofuels producers already rely on LIMS as part of an integrated data management platform. A true enterprise-enabled LIMS harmonises with other enterprise and lab systems, such as a chromatography data system (CDS). In the case of a CDS, next-generation biofuels labs rely heavily on gas and ion chromatographic methods to proactively monitor quality and yield, and keeping this data in isolation would be severely delimiting.

Data isolation is unwise and avoidable. Even when labs purchase analytical instruments from different manufacturers — many of which come

with a proprietary CDS — they'd be wise to look for software that is instrument agnostic. Doing so can dramatically increase efficiency, streamline data handling and simplify training, validation and compliance. The goal is to aggregate data in one format for analysis and rapid reporting. In other words, it shouldn't matter what instrument generated the data. And, with the right CDS, it doesn't.

### Benefits of automation

An instrument-agnostic CDS connected to the enterprise through a LIMS can do much more than provide analysis and reporting. A CDS can also help increase instrument uptime, especially important for labs running 24/7. A CDS can and should also be capable of running independent of the enterprise client/server network if necessary — an outage mustn't and shouldn't affect analyses or access to critical data needed for production. Labs must be able to support around-the-clock production.

The CDS supports 24/7, uninterrupted production by ensuring that technicians are strictly following analytical methods. Some CDSs provide an even higher level of automation by encapsulating all of the unique aspects of a chromatography workflow — such as instrument control and data processing parameters, correct injection order and reporting parameters, and guiding operators through the minimal steps required to run it. Complex steps in a process, such as testing for ASTM D6584 and EN 14105 to ensure quality, are simplified to instrument selection, number of samples and starting vial position in the autosampler to begin the analysis. The software will automatically run the chromatograph, process the data and produce final results.

Complex analyses, such as those required for ASTM D6584 and EN 14105, are challenging because they require complex and time-consuming sample and calibration prep and they must be run in duplicate to ensure analytical accuracy. But with a CDS, this complexity can be reduced to a few clicks, delivering fast, accurate results with an audit trail of all steps. This is automation with accountability.

Automation extends all the way to the often time-consuming data processing and evaluation

phases of chromatography. This can take excessive time even if all data processing parameters are properly set up in the chromatography workflow. In this case, the CDS assists technicians by letting them set up intelligent run control parameters to decide if a sample passed or failed for re-analysis. Outcome response in the software then takes predefined, immediate action, such as reinjecting samples, performing a dilution or aborting a run without user intervention.

A final integration between the LIMS and CDS ensures rapid and comprehensive access to quality results. Any samples not meeting specifications established by ASTM and EN are appropriately flagged as out of specification in the LIMS and preventive action can be taken. This high level of automation enables labs to be catalysts for increased productivity without compromising critical product quality.

### Conclusion

The rapidly growing biofuels industry will face complexity on an unprecedented scale. To deliver quality at sufficient quantity, labs will require new instruments and will generate more data that must be managed and analysed with rigour.

But this is an opportunity, not a burden, especially with modern LIMS and CDS to help drive efficiency, uptime and quality. Together, these industry-proven software platforms can support continuous process monitoring and data management when, where and how biofuels production stakeholders need it. This will be important as the transportation industry, aerospace and other industries move from pilot projects to full-scale operations that require biofuels producers to bring more high-quality product to market to meet new demand.

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*Thermo Fisher Scientific  
www.thermofisher.com.au*



## Biomolecular imagers

Amersham Typhoon biomolecular imagers are the next-generation range of Typhoon FLA scanners from GE Healthcare's Life Sciences business.

Four instruments in one, the imagers offer versatile imaging and precise quantitation of fluorescent, colour-stained and radio-labelled biomolecules like proteins and nucleic acids. With sensitive detection, down to 3 pg of protein, a combination of phosphor imaging, red, green and blue (RGB) fluorescence, near-IR fluorescence (NIR) and OD measurement are delivered in a single instrument.

The five-laser configuration option and photomultiplier tubes (PMTs) deliver a good degree of fluorescent multiplexed detection, and its broad linear dynamic range provides the enhanced sensitivity required to detect subtle differences in protein levels. Phosphor imaging allows for radiolabelled target detection with high sensitivity.

The device can image gels, membranes, multiwell plates, dishes and tissue sections, and its modular configuration allows detection modalities, stages, detectors and filters to be selected and updated as required. Coupled with auto- and semi auto-scan functions, automatic filter recognition and modular access for multiuser environments, a large 40 x 46 scanning area increases sample throughput and ease of handling.

For more information: <http://gelifesciences.com/Typhoon>.

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## Rapid liquid biopsies for melanoma patients



The Olivia Newton-John Cancer Research Institute (ONJCRI) is using blood test technology from Bio-Rad Laboratories to detect and analyse cancer genes in melanoma patients. The blood test, called a 'liquid biopsy', is essentially a blood sample that researchers can use to detect fragments of circulating tumour DNA that carries certain mutations in the **BRAF** gene.

For advanced (Stage 4) melanoma, it is critical that a patient is treated as soon as possible. But finding out if a patient has a **BRAF** V600E or **BRAF** V600K mutation from a tissue biopsy takes between usually 2–3 weeks. A liquid biopsy can provide the same information in less than three days — or even within 24 hours in urgent cases. And if a patient tests positive for the gene mutation, their doctor can prescribe a drug that targets the mutated **BRAF** protein.

"These tests are done quickly, and without surgery so there is no pain and reduced anxiety for the patient," said Professor Jonathan Cebon, medical director of the Olivia Newton-John Cancer Wellness & Research Centre (ONJ Centre) and ONJCRI. "We can make treatment recommendations sooner and we can monitor treatment response regularly rather than waiting for the next scan, which might be months away."

The blood samples are being tested on Bio-Rad's Droplet Digital PCR (ddPCR) system — a digital PCR method utilising a water-oil emulsion droplet system. The system partitions nucleic acid samples into 20,000 nanolitre-sized droplets, and PCR amplification is carried out within each droplet. This partitioning enables the measurement of thousands of independent amplification events within a single sample, thus determining the target DNA template concentration in the original sample. The system also has a smaller sample requirement than other commercially available digital PCR systems, reducing cost and preserving samples.

The approach is already saving lives, such as that of a patient at the ONJ Centre who was given days to live after his metastatic melanoma went into rapid decline. A liquid biopsy was taken and researchers performed the blood test in less than six hours. The results enabled Professor Cebon to prescribe a drug that immediately inhibited the growth of the cancer.

The use of liquid biopsies in the clinic is anticipated to increase with the rise of personalised medicine, helping clinicians to obtain more information about their patients and thus be more precise in their treatment recommendations. Professor Cebon said, "We expect to see liquid biopsy become a standard option for a number of cancer types in the next few years."

The research institute has now become the first laboratory in Australia to be NATA accredited for the blood test technology. Doctors and medical oncologists can order the test from anywhere in Australia.

**Bio-Rad Laboratories Pty Ltd**  
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what's new

### Fuming chamber

The Air Science SafeFume Cyanoacrylate Fuming Chamber has been designed to safely develop latent fingerprints using ethyl cyanoacrylate (CNA) vapour in a controlled environment.



The product is said to deliver optimum effectiveness and safety where moisture and fuming time are critical factors. The tamper-resistant compartment helps maintain the chain of custody, while the Air Science Multiplex filtration system, together with professional design and construction features, offers personnel protection during use.

The ductless filtration system requires no connection to an outside exhaust system. The automatic control system programs the fuming cycle. A versatile system of hanging rods and shelves allows proper positioning of items of evidence in the chamber.

Relative humidity is established via a water-filled nebuliser/humidifier, while a hot plate accelerator polymerises ethyl cyanoacrylate for a specific time interval. Fumes are removed from the chamber through the Multiplex filtration system via a carbon filter; air is safely exhausted to the room.

Other features include cabinet temperature display, door status with lock alarm, circulation fan on/off and hot plate on/off. An optional electronic gas sensor emits an audible and visual warning when the main filter must be changed.

The product is available in 24", 30", 48", 60" and 72" models.

**LAF Technologies Pty Ltd**

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

### Gas-permeable microtitre plates

VECELL gas-permeable plates from Cosmo Bio consist of a hybrid of a high-porosity membrane and gas-permeable membrane. Oxygen can be supplied from the bottom of the wells, providing a close to in vivo condition for cell culture. The plates are useful for high content screening.

Black and white coloured plates are available individually and also in packs of 10. A trial set of 24-well plates is also available, which includes three kinds of plates (Preset VECELL, H-Plate and G-Plate).

**United Bioresearch Products Pty Ltd**

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



# Dewetting — the opposite of spreading

UK researchers have made the first ever direct observation of the elusive dewetting process, which takes place when a liquid film retracts to form a bead-shaped drop. Their achievement could lead to breakthroughs involving the use of liquids, such as better coatings and more effective self-cleaning surfaces.

**D**ewetting is the opposite of spreading, in which a bead-like drop of liquid falls onto a surface and slowly spreads to form a thin film. Dewetting, on the other hand, occurs when a liquid film retracts from a solid to form a bead-shaped drop, which can be observed when a wet window is left to dry up.

Despite its apparent simplicity, the direct observation of the full dewetting of a droplet into a single drop had remained elusive and difficult to achieve. Scientists from Northumbria University and Nottingham Trent University recently came up with an ingenious solution to this problem, the results of which have been published in the journal *Science Advances*.

Using a novel method known as dielectrowetting, the research team exploited the electric properties of liquids to force a liquid to

coat a solid surface using an applied voltage. By embedding very thin patterned electrodes in the solid and carefully arranging them into a circular pattern, they achieved the formation of a thin circular liquid film. By switching off the voltage, they revealed, for the first time, the full dewetting process of the liquid film back to a bead-like drop shape.

“At first sight, one might have expected that dewetting is just the time-reversal of spreading,” said Professor Carl Brown from Nottingham Trent. “Surprisingly, we found that dewetting is not spreading in reverse. Instead of a smooth sequence of drop-like shapes, the dewetting film forms a rim at its own edge, which retracts at constant speed for most of the dewetting process.”

To understand this behaviour, the team used a combination of theory and numerical simulations to rationalise the experiments.

Dr Rodrigo Ledesma-Aguilar, from Northumbria, said: “Both the simulations and the theory support that the liquid tends to adopt

the closest local equilibrium shape it can during dewetting. This explains the smooth rim shape which survives for most of the process.”

So what can the researchers achieve with their newfound knowledge? Dr Michael Newton, from Nottingham Trent University, said, “Our method can be used to learn more about the underlying physics behind other dewetting phenomena such as condensation, evaporation and droplet rebound. These processes are critical for applications such as fog-collection, coating and lubrication. The technique developed can also be used for characterising liquid properties when only small volumes are available.”

Professor Glen McHale, Pro-Vice Chancellor (Engineering and Environment) at Northumbria University, added, “Our experimental set-up opens up the possibility of preparing liquid shapes in a very controlled manner, which then dewet. This can lead to new methods for liquid manipulation in technologies such as coating and self-cleaning surfaces.”



## Amino acid analysers

Automatic amino acid analyser systems from SYKAM Germany combine the advantages of classical ion exchange separation methods with the modern technique of high-performance liquid chromatography. The S 435 and S 436 are the latest generation of amino acid analysers.



The specialised analyser series, for any routine or research in amino acid determination, is a complete package of sophisticated instrumentation that includes prepacked and tested separation columns combined with optimised ready-to-use buffer solutions. A compact design includes intuitive software, a cooled reagent organiser with inert gas

pressure, a cooled sample injector, a 2-channel LED detector, a column oven, an enhanced column regeneration system, a power fail safety system, and a reagent and gradient pump.

The system utilises multistep separation, wherein up to three buffer solutions combine to form an optimised buffer profile at any part of the separation program.

**Chromatech Scientific**

[www.chromatechscientific.com](http://www.chromatechscientific.com)

## Inverted microscope platform

The Eclipse Ti2 delivers a 25 mm field of view (FOV). It maximises the sensor area of large-format CMOS cameras without making compromises and improves data throughput.

The stable, drift-free platform is designed to meet the demands of super-resolution imaging, while its hardware-triggering capabilities enhance challenging, high-speed imaging applications. Furthermore, the product's intelligent functions guide users through imaging workflows by gathering data from internal sensors, eliminating the possibility of user errors. The status of each sensor is automatically recorded during acquisition, providing quality control for imaging experiments and enhancing data reproducibility.

In combination with Nikon's powerful acquisition and analysis software, NIS-Elements, the microscope platform provides innovative imaging.

**Coherent Scientific Pty Ltd**

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



## Dynamic shear rheometer for asphalt testing

The Kinexus DSR is a dynamic shear rotational rheometer designed to meet R&D requirements in the asphalt sector, enabling optimal flexibility in rheological protocols and test capabilities.

Engineered from the ground up, the rheometer allows users to spend less time learning how to interact with their system and more time investigating ways to characterise and enhance a material's performance. An innovative 'plug and play' cartridge system for temperature controllers enables all set-up to be performed in one simple step.

The product's grade testing features comply with industry standards such as EN and AASHTO specifications. Its numerous measurement geometries are designed for rheological characterisation of liquid binders as well as solid asphalt cores.

The product features all modes of rheological operation, such as stress, shear rate and direct strain controlled oscillations. It provides the full sample history from the first step of loading onto the rheometer.

The innovative rSpace software interface offers flexibility of test set-ups spanning from sequence-driven SOP-type functionality to wholly customisable test designs. A penetrometer adapter enables automatic penetration testing of asphalt binders.

**ATA Scientific Pty Ltd**

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



### Next-day *Cronobacter* test

*Cronobacter*, also known as *Enterobacter*, is an opportunistic pathogenic bacteria responsible for foodborne illness. *Cronobacter* is able to survive in desiccated states for extended periods of time, which means that it can be a problem in powdered dairy products.

As *Cronobacter* is known to cause severe complications in infants, such as sepsis, enterocolitis and meningitis, it is important to screen for this organism in infant formulas. Traditional methods for detection include culturing, which can take 3–5 days and involves multiple steps and a high degree of expertise.

The Assurance GDS (Genetic Detection System) offers a *Cronobacter* species result in 26 h for infant formula, powdered milk and environmental samples. The GDS is a highly sensitive, highly specific PCR platform for pathogen screening. The method for *Cronobacter* testing is a simple one-step enrichment, followed by amplification and detection in the thermal cycler.

The system is suitable for use in most processing plants and laboratories.

**Australasian Medical & Scientific Ltd**

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



### Manual translation stages

Thorlabs has released the XR-Series cross roller bearing, aluminium-bodied translation stages. The initial release includes both rear- and side-actuated 1" travel stages and all components needed to have left- or right-handed X, XY, XZ, YZ and XYZ configurations.

A dovetail feature is incorporated into the design for stacking; it could also be used to provide custom mounting options. When stacking two stages, coarse positional alignment in the axis perpendicular to stage travel is achieved by sliding the dovetail along the mating dovetail prior to lockdown.

The stages can be customised to accommodate custom footprints, deck heights and hole patterns.

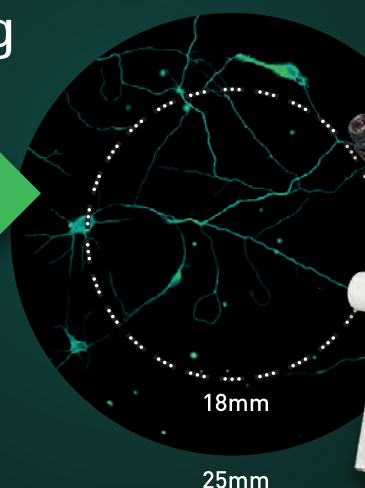
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# Faulty gene linked to asthma, diabetes and depression

According to the World Health Organization, over 350 million people suffer from depression, making it the single largest cause of disability worldwide.

Identifying a single biological cause for depression has proved elusive, but researchers from the University of Adelaide have found a physiological link between asthma, heart disease and depression that all leads back to a single faulty gene.

Pouring over thousands of peer-reviewed studies, a team from the university's Discipline of Psychiatry has found a faulty gene — *PXMP2* — that is linked to cardiovascular and metabolic conditions, supporting a hypothesis that depression and cardiovascular diseases may share molecular pathways.

"With the shared pathways between cardiovascular disorders and depression, we suggest that faulty regulation of the *PXMP2* gene may play a role in depressive disorders via specific metabolic pathways," said the paper's lead author, Professor Bernhard Baune. "Depression is much more complex than most people think, and it includes dysfunction at multiple biological levels, from genes to brain regions, and blood circulating through the body."

Professor Baune's team re-analysed a wealth of existing data, concentrating on the genes that appeared in multiple studies, identifying 57 differently expressed genes in the brain and 21 in the peripheral

tissues. Professor Baune explained: "What we saw was overlap in genetic expression between the brain and peripheral tissues that strongly implicated a link between depression and cardiovascular disease."

"Our research on genetic networks also showed support for the wide range of theories that different genes may play a role in depression, including those involved in regulation of serotonin, melatonin and the immune system, among many others. Even so, *PXMP2* represents a very strong, new target for future research programs."

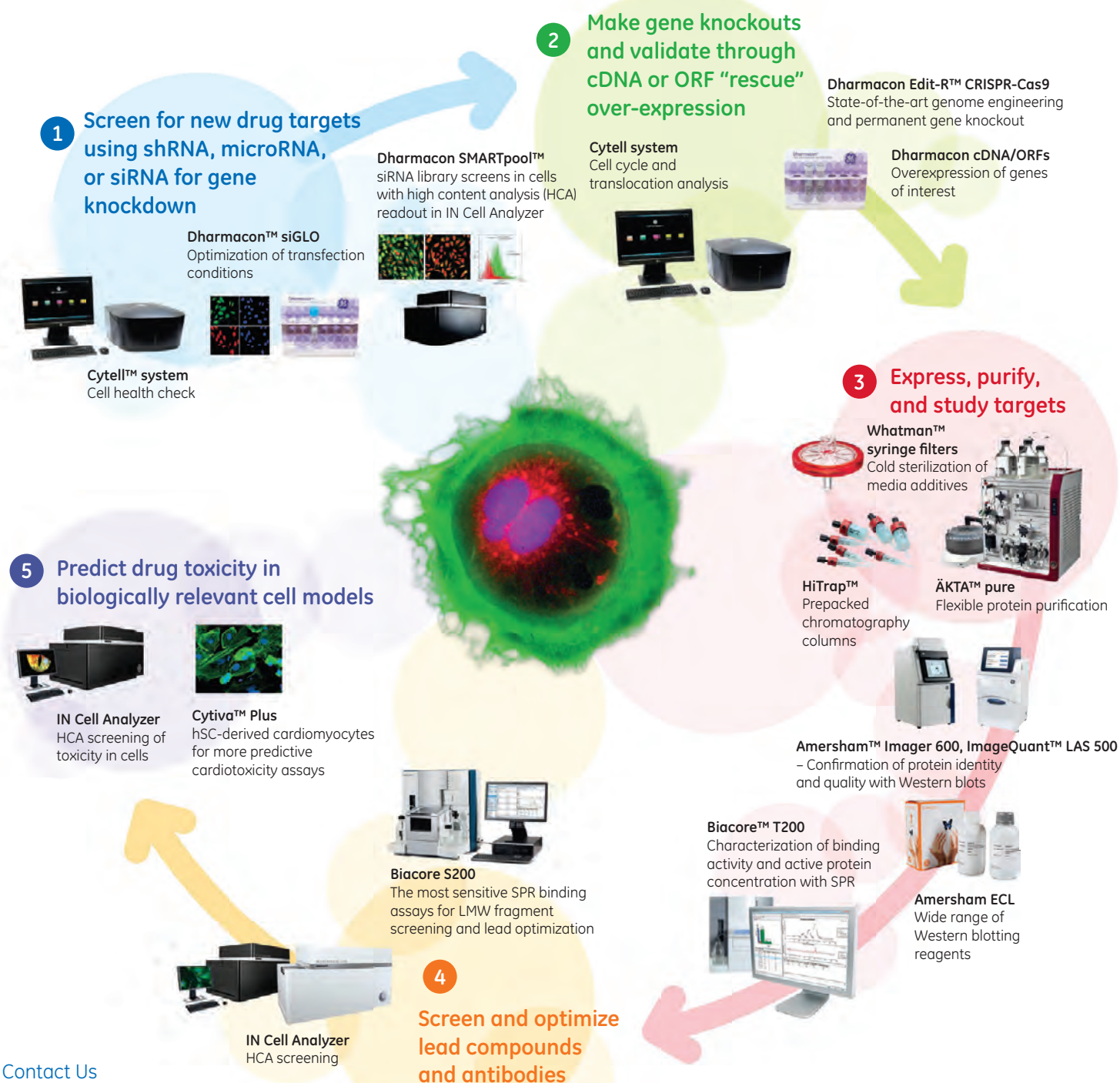
It has long been known that there is a high incidence of comorbidity between depression and chronic somatic diseases including diabetes, asthma and cardiovascular disease. This research supports the hypothesis of overlapping mechanisms involved in the pathophysiology of these non-psychiatric diseases and depression.

"*PXMP2* is robustly expressed during depression," said Professor Baune. "However, to the best of our knowledge, neither this faulty gene in particular nor its related functions in metabolism have ever been investigated in relation to mood disorders of any kind."

This research has been funded by the National Health and Medical Research Council (NHMRC) and will appear in the journal *Neuroscience & Biobehavioral Reviews*.



# GE in the cancer research lab



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## Center image from Martin Barr

St. James's Hospital & Trinity College Dublin, Ireland  
Lung adenocarcinoma cell stained for F-actin (green), mitochondria (red), and DNA (blue)

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hSC = human stem cells  
LMW = low molecular weight  
ORF = open reading frame  
siRNA = small (or short) interfering RNA  
SPR = surface plasmon resonance



## Automated sample purification system

The Thermo Scientific KingFisher Presto sample purification system is designed to be part of an automated workflow using a liquid handler with a gripper or robot arm to purify samples with volumes from 50  $\mu$ L to 5 mL. The product automates the isolation of target nucleic acids and proteins for biopharma, biotech and research projects in high-throughput laboratories.

The instrument's small footprint allows for easy connection to several liquid handling instruments in a side-by-side or on-deck configuration, allowing flexible selection of platform and use for a wide variety of applications. Stackable, polypropylene KingFisher plates and tip combs are designed to be placed by a robotic arm and suitable for many biological applications, including projects that require a sterile environment.

An extension of KingFisher technology, the system uses magnetic particle technology to integrate seamlessly into a variety of workflows, which reduces hands-on time. The system allows users to choose between 24- and 96-head magnets, depending on the volume and throughput requirements.

Thermo Scientific BindIT software accompanies the system for protocol development, allowing users to create and modify their protocols and import Invitrogen and Applied Biosystems nucleic acid and protein purification kits.

**Thermo Fisher Scientific**

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## Graduated wide-neck bottles

Kartell manufactures a range of graduated wide-neck bottles that are autoclavable and meet industry food and drug regulations.

Kartell Graduated Wide Neck bottles are manufactured with a long neck thread that ensures a leakproof closure. They also feature a wide neck, allowing for easy filling and emptying of liquids or powder samples.

The range is known for its sturdy build and rupture resistance. It conforms to DIN 13316 and 168.

The bottles are available in multiple sizes, ranging from 50 to 2000 mL, and are graduated ranging from 10 to 100 mL.

**Sieper & Co Pty Ltd**

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

## Imaging system

Cirdan has announced the PathLite Compact + VividPath PACS, a purpose-built system designed specifically for gross imaging within clinical laboratories. The product automates and simplifies tasks, enabling users to focus on what they do best — pathology.

The lightweight unit can be placed wherever it is required in the lab and at a range of heights. The availability of high-quality images removes the need for lengthy text descriptions and hand drawings, leaving less room for error. One-touch calibration takes under a minute, with no need to recalibrate, and ensures measurement at all zoom levels.

LED lighting is built in for consistent image quality, even in badly lit laboratories. Up to 20x optical magnification ensures the picture quality the user requires. Polarisation filters reduce/remove glare from wet specimens.

Cirdan's VividPath software platform allows images to be accessed wherever and whenever needed. They can be shared easily for teaching, research or second opinion purposes. Full traceability ensures compliance and best practice.

There is a selection of user-friendly control interfaces, including touch screen, keyboard, mouse and foot pedal. There is also a full range of medical-grade accessories, including a 17" touch-screen PC.

**Cirdan Ultra Pty Ltd**

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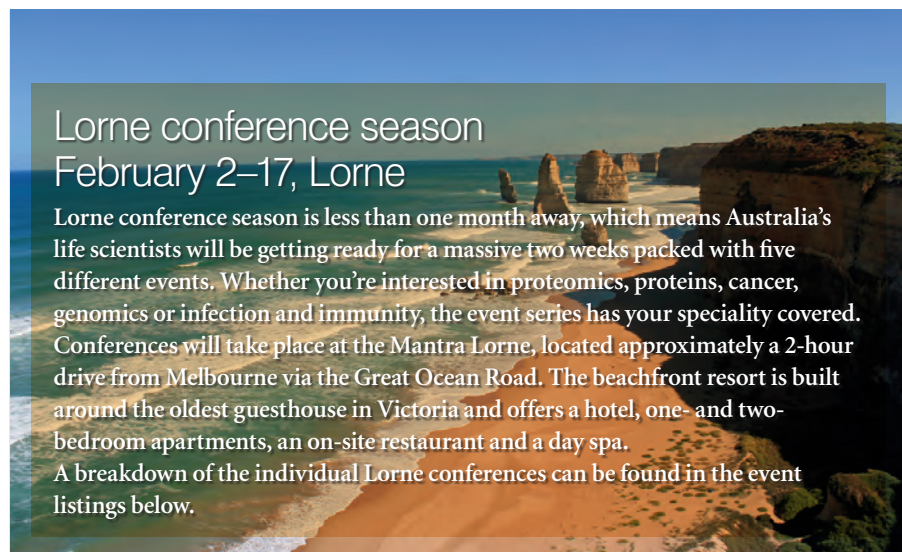


Image courtesy of stolethetv (via Flickr) under CC BY 2.0

## Lorne conference season February 2–17, Lorne

Lorne conference season is less than one month away, which means Australia's life scientists will be getting ready for a massive two weeks packed with five different events. Whether you're interested in proteomics, proteins, cancer, genomics or infection and immunity, the event series has your speciality covered. Conferences will take place at the Mantra Lorne, located approximately a 2-hour drive from Melbourne via the Great Ocean Road. The beachfront resort is built around the oldest guesthouse in Victoria and offers a hotel, one- and two-bedroom apartments, an on-site restaurant and a day spa. A breakdown of the individual Lorne conferences can be found in the event listings below.

### 22nd Lorne Proteomics Symposium

February 2–5, Lorne  
[www.australasianproteomics.org.au](http://www.australasianproteomics.org.au)

### GAME 2017

February 3–9, Melbourne  
[www.embl-abr.org.au/game2017/](http://www.embl-abr.org.au/game2017/)

### 42nd Lorne Conference on Protein Structure and Function

February 5–8, Lorne  
[www.lorneproteins.org](http://www.lorneproteins.org)

### 2017 AXAA Conference and Exhibition

February 5–9, Melbourne  
[www.cvent.com/events/axaa-2017-workshops-conference-exhibition/event-summary-a23b418b8c4341ad91cdca5c21edcb2f.aspx](http://www.cvent.com/events/axaa-2017-workshops-conference-exhibition/event-summary-a23b418b8c4341ad91cdca5c21edcb2f.aspx)

### 29th Lorne Cancer Conference

February 9–11, Lorne  
[www.lornecancer.org](http://www.lornecancer.org)

### Mineral Exploration Seminar

February 10, Perth  
<https://events.csiro.au/Events/2016/November/8/Mineral-Exploration-Seminar-2017>

### 38th Lorne Genome Conference

February 12–14, Lorne  
[www.lornegenome.org](http://www.lornegenome.org)

### 7th Lorne Infection and Immunity Conference

February 15–17, Lorne  
[www.lorneinfectionimmunity.org](http://www.lorneinfectionimmunity.org)

### ASC2017

February 23–24, Adelaide  
<http://2017conf.asc.asn.au/>

### Realising SKA-Low

March 29–31, Perth  
[www.icrar.org/conferences/realising-ska-low/](http://www.icrar.org/conferences/realising-ska-low/)

### Passive and Active Measurement

March 30–31, Sydney  
<https://events.csiro.au/Events/2016/September/15/Passive-and-Active-Measurement>

### Science on the Swan 2017: One Health

May 2–4, Fremantle  
<http://scienceontheswan.com.au/>

### ALTA 2017

May 20–27, Perth  
[www.altamet.com.au/conferences/alta-2017/](http://www.altamet.com.au/conferences/alta-2017/)

### Collaborate | Innovate | 2017

May 23–25, Canberra  
<http://collaborateinnovate.com.au/about-collaborate-innovate-2017/>

### Science at the Shine Dome

May 23–25, Canberra  
[www.science.org.au/news-and-events/events/science-shine-dome](http://www.science.org.au/news-and-events/events/science-shine-dome)

### ASM 2017

July 2–5, Hobart  
[asm2015.asnevents.com.au](http://asm2015.asnevents.com.au)

### ICPEAC XXX

July 26–August 1, Cairns  
<http://icpeac30.edu.au/>

### The Lancet Summit: COPD and Lung Cancer

July 28–29, Perth  
[www.thelancetsummit.com/](http://www.thelancetsummit.com/)

### National Science Week

August 12–20, Australia-wide  
<https://www.scienceweek.net.au/>

### 2017 BMJD Congress

August 31–September 2, Perth  
<http://bmjd-congress.org/>

### Science Protecting Plant Health 2017

September 26–28, Brisbane  
[www.sciplant2017.com.au](http://www.sciplant2017.com.au)

### AusBiotech 2017

October 25–27, Adelaide  
<http://ausbiotechnc.org/>



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