Lab+Life SCIENTIST

Anti-ageing drug just a few years away

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Contents

READ ONLINE! *This issue is available to read and download at* www.labonline.com.au/magazine

Innovation and Science Australia (ISA) has been pretty busy over the last couple of months, releasing both a performance review and an issues paper as part of its plan to drive the national conversation around the future of Australian innovation, science and research.

The performance review, released in February, identifies what is being done well and what can be improved on when it comes to Australia's innovation system. Announcing its findings, ISA Chair Bill Ferris stated that Australia is "good at creating knowledge but simply not good enough at transferring or applying it" — a view that previous domestic and international studies would broadly agree with.

The review suggests that Australia's poor performance in knowledge transfer and application may be partially explained by our low rates of collaboration and mobility among research institutions and businesses compared to the best innovation nations. Ferris also pointed to Australia's preponderance for incremental — rather than radical — innovation as holding the country back.

The ISA is now seeking to overcome these problems with the release of its 2030 Strategic Plan Issues Paper, released last month, which will form the basis for consultations with stakeholders in the development of a Strategic Plan for Australian innovation out to 2030.

The paper identifies some of the waves of change that will influence Australia's future over the medium term — globalisation, technological disruption and demographic trends — and suggests some key challenges the nation must address to become a top-tier innovator. Developing recommendations that respond to these challenges is the focus for ISA's 2030 Strategic Plan, to be delivered to government later this year.

"ISA hopes that the Issues Paper will provoke some big-picture thinking on how Australia can get the most out of our innovation system now and how we can position ourselves as a leading innovation nation into the future," said ISA CEO Dr Charlie Day.

"We look forward to engaging with stakeholders throughout the innovation, science and research system, as well as across the broader Australian public."

ISA will be accepting submissions on the issues raised in the paper until 31 May. To view the paper and make a submission, visit the ISA website.

This will be my last issue as editor of *Lab+Life Scientist*. The WF Media editorial department is having a bit of a reshuffle, which will see my colleague Mansi Gandhi and me switch roles: I'll be taking over her magazine, *What's New in Electronics*, while she'll be coming over here to *LLS*. This means all emails sent to LLS@wfmedia.com.au will be directed to Mansi instead of me from now on. But don't worry — I'll be staying on as Mansi's assistant, so you'll still see my name popping up every now and again.

In this bittersweet moment, I leave you with one of my favourite quotes. And if you've been subscribed to *LLS* since the beginning of my tenure, eight or so months ago, you may be able to guess which TV show it's from:

"One day, I shall come back. Yes, I shall come back. Until then, there must be no regrets, no tears, no anxieties. Just go forward in all your beliefs and prove to me that I am not mistaken in mine."

Regards,
Lauren Davis
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Lauren Davis

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Lauren Davis

US scientists have identified a drug candidate to restore heart muscle function following a heart attack, in a breakthrough which has been described as a game changer for people living with heart disease.

How to heal a broken heart

They say time heals all wounds, but for those who have suffered a heart attack, the reality could not be more different. Even if one is lucky enough to survive such an ordeal, part of the heart muscle dies and the associated scarring interferes with the heart's ability to effectively pump blood. No drug currently exists to restore this muscle function.

While regenerative medicine has so far focused on cell-, gene- and tissue engineering-based therapeutics, the development of small molecule regenerative medicine therapies is an emerging area. Scientists at the MDI Biological Laboratory sought to further explore this arena, recently undertaking a study in zebrafish to identify small molecules capable of stimulating tissue repair and regeneration processes.

"Small molecules offer potential advantages over other regenerative medicine therapeutic strategies including reduced complexity and regulatory hurdles, ready reversibility of the therapy, lack of ethical concerns and likely lower treatment costs," the researchers wrote in the journal *npj Regenerative Medicine*. "However, small molecule discovery and development has to date been constrained by limited understanding of the molecular mechanisms underlying regenerative processes."

The zebrafish already has regenerative capabilities, with the ability to restore the form and function of almost any body part. The researchers aimed to accelerate this process, amputating the caudal fins of adult zebrafish and then giving the creatures daily intraperitoneal (IP) injections of either vehicle or candidate compounds.


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The authors believe MSI-1436 to be the first drug candidate that has been shown to reduce scarring and induce heart regeneration in an adult mammal.

The most successful candidate was found to be a small molecule called MSI-1436, described by the study authors as "a potent and highly selective inhibitor of the ubiquitous protein tyrosine phosphatase 1B (PTP1B)… [which] dephosphorylates and inactivates receptor activated tyrosine kinases".

Originally isolated from the liver of the dogfish shark, 0.125 mg/kg of MSI-1436 was found to increase the rate of caudal fin regeneration by 200–300%, without apparent tissue overgrowth or malformation. Study co-author Viravuth P Yin said this was "definitely a 'Eureka!' moment" and was so astonished that he repeated the study several times under different conditions.

With accelerated regeneration confirmed in the zebrafish's fin, Yin decided to test the process again — this time in the creature's heart. Adult fish were subjected to a partial ventricular resection, removing about 20% of the ventricular mass, and subsequently given daily IP injections of either vehicle or MSI-1436 at 0.125 mg/kg for three days. Without interference, regeneration was expected to be complete within two months.

"To determine whether MSI-1436 increases the rate of heart regeneration, we quantified the expression of Tropomyosin, a muscle specific marker expressed in differentiated cardiac sarcomeres, by immunohistochemistry," the scientists said. Their research showed MSI-1436 treatment increased Tropomyosin expression nearly two-fold within the injury zone.

The third step of the study was to test the molecule in the heart of a mouse — a creature that is separated from the zebrafish by approximately 450 million years of evolution. The researchers noted that while the neonatal mouse heart regenerates in a manner similar to that of the adult zebrafish, this capacity is lost approximately one week after birth.

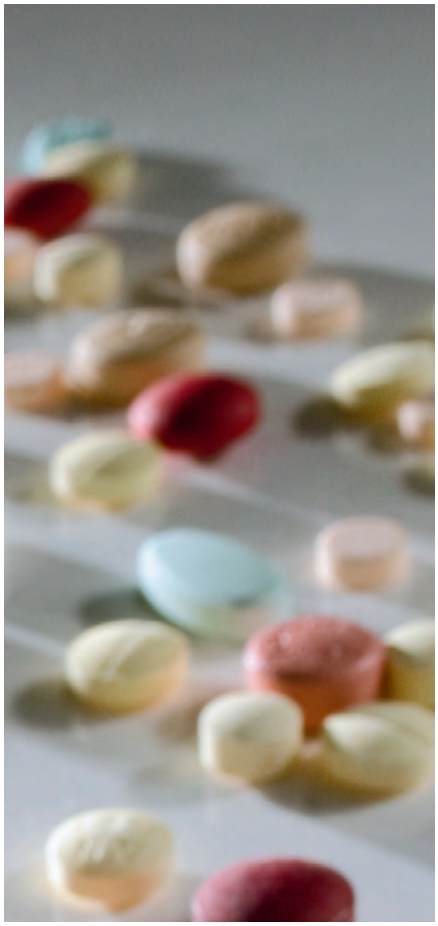
"Ischemic heart injury was induced in 6- to 8-week-old mice by permanent ligation of the left anterior descending (LAD) coronary artery," the study authors said. "These mice were then administered MSI-1436, at either 0.125 or 1.25 mg/kg, or vehicle only, via IP injections."

After four weeks of treatment, MSI-1436 administration increased survival from 55% in vehicle-treated control animals to 70 and 80% in mice administered 0.125 or 1.25 mg/kg MSI-1436, respectively. Other benefits included a two- to threefold improvement in heart function; a 53% reduction in infarct size (0.125 mg/kg); reduced ventricular wall thinning; and a fourfold increase in cardiomyocyte proliferation. The drug was also used to stimulate satellite cell activation in injured mouse skeletal muscle, increasing proliferation twofold without inducing aberrant tissue regeneration.

The authors believe MSI-1436 to be the first drug candidate that has been shown to reduce scarring and induce heart regeneration in an adult mammal. And while it has not yet been tested in the human heart, it has been utilised in Phase 1 and 1b obesity and type 2 diabetes clinical trials, with PTP1B identified as a major pharmaceutical target for possible treatment of these diseases; a PTP1B inhibitor such as MSI-1436 was thus seen as ideal.

"Data consistent with inhibition of PTP1B were reported and the molecule was shown to be well tolerated by patients," Yin and his fellow study authors noted. They added that doses shown to be effective in stimulating tissue regeneration were 5–50 times lower than the maximum well-tolerated human dose.

Other potential applications include the regeneration of skeletal muscle tissue in Duchenne muscular dystrophy, the stimulation of wound healing and regeneration of multiple other tissues, including nervous tissue.



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In collaboration with spinoff company Novo Biosciences, MDI Biological Laboratory is now looking to move MSI-1436 into human clinical trials. The next step will be to test the drug in pigs, the animal whose heart most closely resembles that of humans.

"The path from laboratory bench to patient bedside can be long and difficult," said study co-author Kevin Strange, president of the MDI Biological Laboratory and CEO/co-founder of Novo Biosciences. "But the fact that MSI-1436 has been shown to be safe for use in humans shaves years off the drug development process."

The researchers view their study results as a validation of the MDI Biological Laboratory's and Novo Biosciences' approach to regenerative medicine, which focuses on decoding the 'instruction manual' for repair and regeneration that has been conserved in human DNA for hundreds of millions of years.

"If we can decode the instruction manual for regeneration in highly regenerative species, we can use drug therapies to reignite our own dormant regenerative capacity," said Yin. "Our research in these highly regenerative species is showing that regenerating damaged or lost tissues and organs could be as simple as taking a drug."

Beware of impure reagents

© FreeImages.com/Herman Brinkman

UK researchers are warning their fellow scientists to beware of contaminated commercial reagents, which could skew study results.

In research led by Keele University, scientists found that commercial reagents, which were purchased from highly respected companies, were not pure but in fact contained many contaminants, which had a huge and potentially misleading effect on their work.

As explained by study co-author Professor Sally Roberts, the study was carried out quite by chance.

"Our laboratory purchased the biomolecules from a well-established supplier to investigate their effect on nerve cells, but anomalous results forced us to test their purity," she said. "We were studying what controls nerves growing into patients' intervertebral discs to try and help us understand what causes back pain in a particular group of people.

"Using mass spectrometry and qualitative Western blotting, we discovered unacceptable contamination with other biologically active molecules."

Writing in the journal *Bioscience Reports*, the study authors noted that scientists expect commercial reagents and chemicals to have been "rigorously assessed for their purity". If reagents are misleadingly labelled, said Professor Roberts, they can be a significant drain on researchers' funds and time.

"Testing these molecules can be very expensive and time-consuming, and not all scientists will have the equipment or finances to do so," she said. "One purchase costs hundreds of pounds for just a few milligrams and then for it to be impure is even more costly, because it wastes valuable research time and other resources." More importantly, the authors said, "the effects of these impurities may already have led to inaccurate conclusions and reports in the literature". Indeed, Professor Roberts indicated that many branches of science and medicine have apparently been looking at the same molecule as her team — and bought the same material from the same company — which begs the question as to how many studies have been adversely affected.

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Diamond-based sensor inspired by a sonic screwdriver

Physicists led by the Australian National University (ANU) have designed a handheld device that uses the power of MRI and mass spectrometry to perform chemical analysis of objects. Their inspiration? The sonic screwdriver used in science-fiction program *Doctor Who*.

The multipurpose sonic screwdriver wielded by the program's alien Doctor is used, among other things, to scan and identify matter. Now, Dr Marcus Doherty and his team have proven the concept of a diamond-based quantum device to perform similar functions.

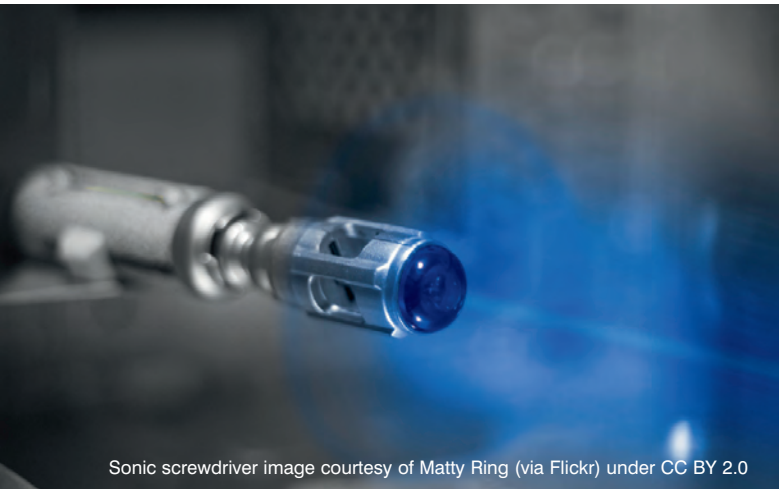
Writing in the journal *Nano Letters*, the researchers explained that their device seeks to combine nanomechanical sensors and quantum nanosensors: two rapidly developing technologies that have "diverse interdisciplinary applications in biological and chemical analysis and microscopy". They will achieve this by creating a nanostructure within a piece of diamond, with atomic-scale defects embedded within that nanostructure. "We got a big diamond, and I got a pneumatic press, and I put a literal tonne of force to measure the mechanical stability of our defects," said co-researcher Michael Barson. Using this data, along with advanced quantum techniques borrowed from atomic clocks and gravitational wave detectors, the device will be able to measure the mass and chemical composition of molecules.

"For the mass spectrometry, when a molecule attaches to the diamond device, its mass changes, which changes the frequency, and we measure the change in frequency using the defects in the diamond," said Barson.

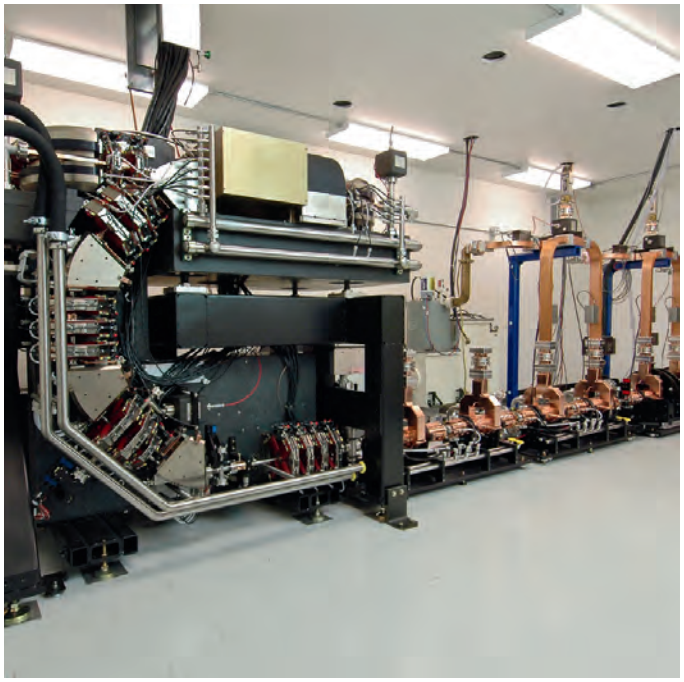
"For the MRI, we are looking at how the magnetic fields in the molecule will influence the defects as well."

The researchers are thus taking the capabilities of both MRI machines and mass spectrometers — two large and powerful instruments — and putting them into a single chip. This removes barriers to access, enabling hospitals, laboratories and more to carry out full chemical analyses on a cheap, portable, mass-producible device.

Giving just one example of the device's capabilities, Dr Doherty said it could be used by medical researchers to weigh and identify complex molecules such as proteins, which drive diseases such as cancer, and cures for those diseases. "Our invention will help to solve many complex problems in a wide range of areas, including medical, environmental and biosecurity research," he said.



Sonic screwdriver image courtesy of Matty Ring (via Flickr) under CC BY 2.0



The Lyncean Compact Light Source is a laboratory-based mini synchrotron for the production of high-brilliance radiation.

AXT to distribute 'mini synchrotron'

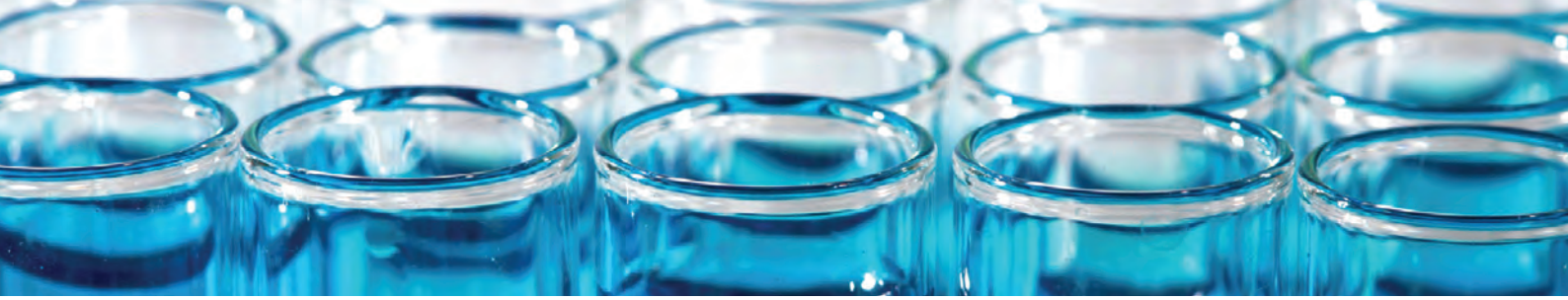
Lyncean Technologies, the manufacturer of the Lyncean Compact Light Source (CLS), has signed scientific equipment supplier AXT as its exclusive representative in Australia and New Zealand.

Comparable in size to a stadium, a synchrotron requires massive infrastructure investments and a significant number of highly technical support staff. The CLS is 200 times smaller yet comparable in light intensity, allowing it to fit in a typical laboratory space and to be more easily accessed by researchers.

Unlike conventional laboratory sources, the CLS creates a narrow beam of nearly monochromatic X-rays which are adjustable in energy — a feature unique to synchrotron radiation. Suitable for numerous imaging, diffraction, fluorescent and scattering experiments carried out at synchrotron facilities, it is designed to be operated by a postdoc, graduate student or beamline scientist.

AXT will be responsible for growing the academic research market for Lyncean as well as providing frontline service and operational support for future installations.

"We are excited to represent Lyncean and see a tremendous potential for the Lyncean Compact Light Source as a complement to the Australian Synchrotron," said AXT Managing Director Richard Trett. "Both university researchers and beamline scientists at the synchrotron have voiced the desire for a regionally located, laboratory-based source. It provides a complementary capability, additional beamline capacity, and could be used for optimising experiments. It also opens up whole new areas of science, in particular to experimentalists unable to travel with their experiments or who can't gain access to the required time on beam lines."



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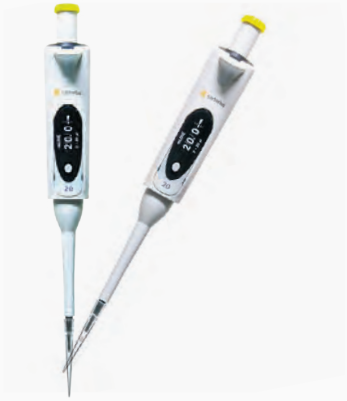

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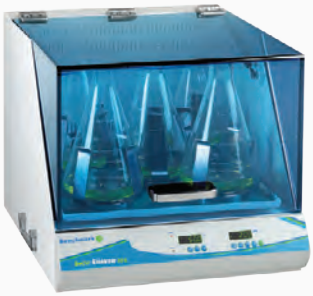

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An alternative to antibiotics for CF patients

UK scientists have shown that bacteriophage (phage) therapy could offer a safe and effective alternative to antibiotics in the treatment of cystic fibrosis (CF) lung infections. Their study has been published in the journal *Thorax*.

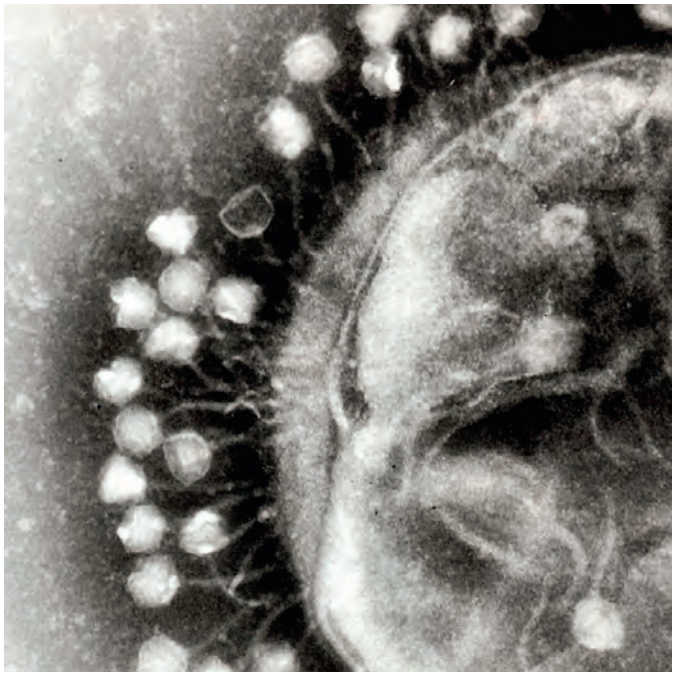
Chronic lung infections caused by the bacterium *Pseudomonas aeruginosa* are becoming increasingly difficult to treat due to antimicrobial resistance. With limited alternative therapeutic options available, this has led to renewed interest in the use of phages — viruses that infect and kill bacteria but are otherwise harmless.

A major advantage of phages is that they only target the harmful bacteria, so there are less of the side effects often associated with antibiotics. Unfortunately, phage therapy has not had the same level of funding as drug development due to a lack of convincing preclinical efficacy studies.

Now, researchers led by the University of Liverpool have shown that phage therapy is highly effective in treating established and recalcitrant chronic respiratory tract infections caused by multidrug-resistant *P. aeruginosa* strains. Significantly, they show that phages are capable of killing the bacteria in long-term infected lungs, such as those suffered by patients with cystic fibrosis.

"Cystic fibrosis patients face the prospect of life-long treatment with antibiotics, which often prove ineffective and can have side effects, especially when used for long periods," said Professor Craig Winstanley, who co-led the study. "Hence, phage therapy could be a particularly valuable addition to the treatment of chronic lung infections in these patients."

The WHO recently identified *P. aeruginosa* as one of the key pathogens against which there is a critical need to develop new therapies. In light of this, the study provides valuable preclinical evidence for phage therapy being a viable option.



Transmission electron micrograph of multiple bacteriophages attached to a bacterial cell wall; the magnification is approximately 200,000. Image courtesy of Dr Graham Beards (via Wikimedia Commons) under CC BY-SA 3.0

Introducing the new standard for protective gloves

Regulations for gloves that protect against dangerous chemicals and microorganisms have changed. The new EN ISO 374 standard refines the required capabilities for gloves that protect workers whose hands are subject to chemical and/or microorganism exposure.

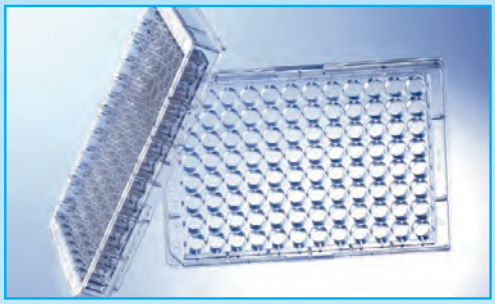
It introduces six new common workplace chemicals to the list of common industrial chemicals and defines three new levels of glove performance against chemical permeation which are identified by new markings and requirements:

- **EN ISO 374-1/ Type C:** more than 10 min protection from permeation of at least one chemical from the list.
- **EN ISO 374-1/ Type B:** more than 30 min protection from permeation of at least three chemicals from the list.
- **EN ISO 374-1/ Type A:** more than 30 min protection from permeation of at least six chemicals from the list.

The updated standard also calls for a new viral penetration test.

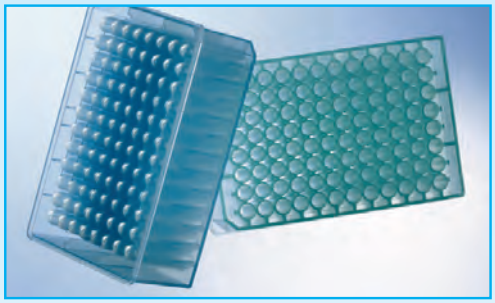
If a glove passes this extra test, the word "virus" will be added under the microorganism pictogram.

The Power of Research

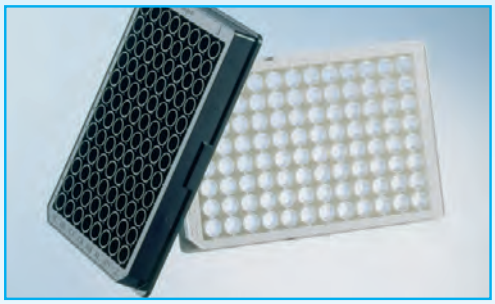


Microscopic Analysis

Elisa / Immunology



Sample Storage



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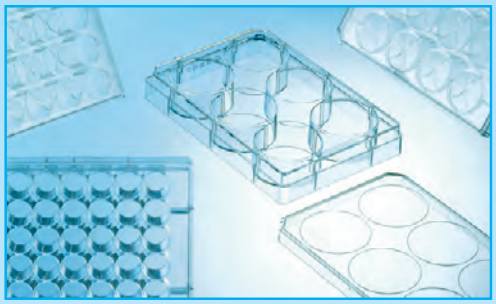
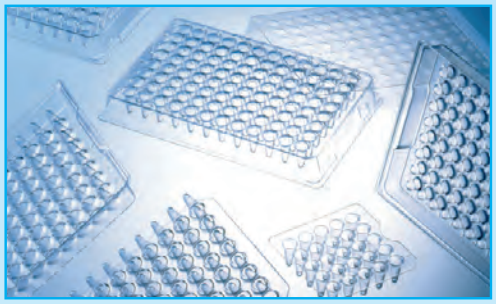


Cell Culture



Molecular Biology / Real Time PCR

Protein Crystalisation

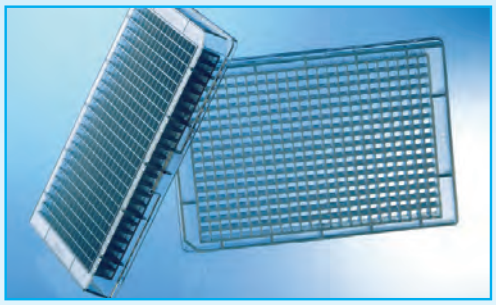


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Image credit: Kent Vliet.

Fighting superbugs with dragon blood

US scientists have been investigating the survival mechanisms of Komodo dragons, which live on five small islands in Indonesia. The creatures thrive in this environment, despite being exposed to scads of bacteria that would kill less hardy creatures — in fact, the dragons' own saliva contains at least 57 species of bacteria, which are believed to contribute to the demise of their prey.

Substances known as cationic antimicrobial peptides (CAMPs) are produced by nearly all living creatures and are an essential part of the innate immune system. This immune system is particularly robust in Komodo dragons, with serum taken from the animals found to contain antibacterial activity. Researchers at George Mason University wondered whether they could isolate CAMPs from Komodo dragon blood, as they previously had done with alligator blood, to expand the library of known CAMPs for therapeutic studies.

Using an approach known as bioprospecting, the team incubated Komodo dragon blood with negatively charged hydrogel particles that they developed to capture the peptides, which are positively charged. With this method, they identified and sequenced 48 potential CAMPs with mass spectrometry. All but one of these was derived from histone proteins, which are known to have antimicrobial activities. Eight were synthesised and tested against *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Writing in the *Journal of Proteome Research*, the study authors revealed that seven of the peptides showed significant potency against both bacteria tested (the eighth was only effective against *P. aeruginosa*). The scientists thus concluded that Komodo dragon blood plasma contains a host of potentially viable antimicrobial peptides that could help lead to new therapeutics.

3D-printed sternum successfully implanted

A collaboration between CSIRO, Melbourne medical implant company Anatomics and British doctors has resulted in the world's first implementation of a 3D-printed titanium and polymer sternum into a patient.

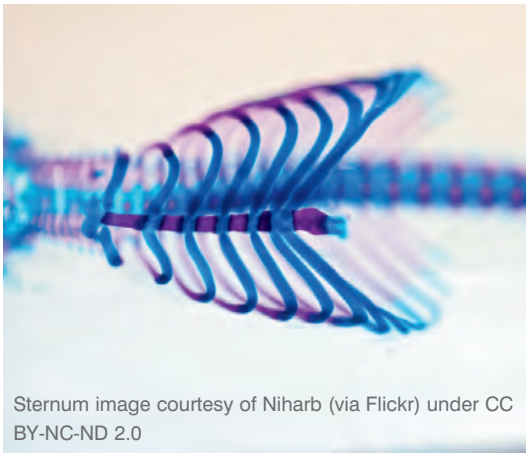
Designed by Anatomics and printed at CSIRO's Lab 22 facility in Melbourne, the implant was custom made for 61-year-old Edward Evans, who had previously had his sternum removed due to a rare infection. While Evans recovered well from this initial surgery, the absence of a solid sternum meant that his heart and lungs were left extremely vulnerable.

Sternum implants are typically made from a hand-moulded cement block wedged in a synthetic mesh, but doctors have been searching for a better, more modern alternative. Evans' surgeon found this alternative by contacting Anatomics, which is a world leader in the design and manufacture of bespoke surgical implants.

Anatomics designed a sternum featuring titanium — a strong, lightweight, biologically compatible metal that is not rejected in human bodies. The company's designs were then sent to CSIRO, where they were fed into a 3D printer full of powdered titanium. The particles were fused together layer by layer by an electron beam until a sternum had been printed that would precisely fill the defect in Evans' chest.

The printed sternum was returned to Anatomics for processing and cleaning and was coated in porous polyethylene — a substance manufactured to create a bone-like porous architecture and which also helps with tissue adhesion. Finally, the implant was sterilised and shipped to the UK for surgery.

The operation marked the first time a titanium sternum combined with a synthetic polymer has been used to replace bone, cartilage and tissue in a patient. Evans has since made a successful recovery, with motion capture tests finding that his breathing and chest movements have been corrected.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What's my age again?

Anti-ageing drug just a few years away

Researchers from the UNSW School of Medical Sciences and Harvard Medical School are just six months away from human trials of a new drug that appears to repair damaged DNA, reversing the effects of radiation and ageing.

Professor David Sinclair and Dr Lindsay Wu have spent four years isolating the metabolite NAD+, which helps regulate protein-to-protein interactions essential during our cells' naturally occurring DNA repair capabilities. This natural cell repair function declines as we age and when exposed to radiation, including sunlight.

The team has developed a NAD+ precursor, or 'booster', which has proven highly effective in reversing radiation damage and ageing in laboratory mice.

Professor Sinclair stated: "The cells of the old mice were indistinguishable from the young mice, after just one week of treatment. This is the closest we are to a safe and effective anti-ageing drug that's perhaps only three to five years away from being on the market if the trials go well."

Published in *Science*, this research has attracted the attention of NASA, winning the US space agency's iTech competition. NASA is hopeful this drug will help keep its astronauts healthy during a four-year mission to Mars, staving off the effects of cosmic radiation that impact astronauts' health on even short missions. As well as astronauts, Dr Wu said this new drug may be able to help survivors of childhood cancers, most of whom go on to suffer from chronic conditions like diabetes, cardiovascular disease and Alzheimer's disease by age 45. "All of this adds up to the fact they have accelerated ageing, which is devastating," he said. "It would be great to do something about that, and we believe we can with this molecule."

Following on from Professor Sinclair's 2003 success in making the link between resveratrol, the naturally occurring molecule found in red wine, and the anti-ageing enzyme SIRT1, he and Dr Wu have been looking at other proteins and molecules which may impact the ageing process.

Professor Sinclair stated: "While resveratrol activates SIRT1 alone, NAD+ boosters activate all seven sirtuins, SIRT1-7, and should have an even greater impact on health and longevity."

It has taken Professor Sinclair and Dr Wu's company, MetroBiotech — in conjunction with the UNSW Laboratory for Ageing Research — four years to make NMN into a drug substance. Human trials are slated to commence at Boston's Brigham and Women's Hospital later this year.

maxon product range

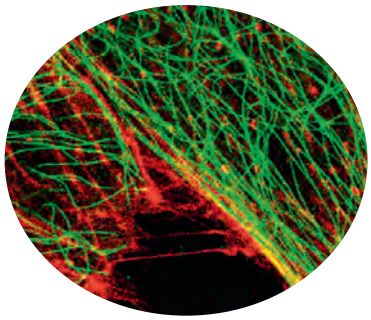
The solution is always a matter of the right combination.

maxon DCX motors are configurable online via maxons interactive web based configuration portal. This allows a customer to change the motors shaft shape and dimensions, the gearhead features, the mounting holes, the winding and even the connectors. As more mechatronic and automation engineers use the technology the products available online expand. Recently we have seen the addition of 12 mm, 14 mm and 16 mm micro DC motors as well as “mix and match” different motor and gearhead diameters.

maxon motor australia Pty Ltd., Unit 1, 12-14 Beaumont Road, Mount Kuring-Gai, NSW 2080, +61 2 9457 7477, www.maxonmotor.com.au

maxon motor

driven by precision



Super-resolution fluorescence microscope

Oxford Nanoimaging (ONI) has released the Nanoimager, a super-resolution fluorescence microscope capable of single-molecule imaging.

The Nanoimager is an elegant yet robust bespoke platform that is said to simplify and increase the efficiency of fluorescence imaging, providing levels of detail not previously possible. This provides researchers with more information about the ultrastructure of cells and the interactions and dynamics of single molecules. It is suitable for research in biology, streamlining the development of novel assays and sensors.

The product offers established single-molecule localisation microscopy methods such as d-STORM and PALM, which are capable of imaging at high temporal resolution. This enables users to capture super-resolution images that routinely demonstrate sub 20 nm resolution, making it suitable for researchers working in areas such as cell biology, protein assemblies, epigenetic mapping, exosomes and microvesicles.

The simple design eliminates the need for optical benches and vibration damping and allows the system to be placed into any laboratory setting. The resultant compact size and desktop form factor enable the unit to have minimal drift. The optimised closed microscope design also reduces maintenance, while providing high throughput levels and automation.

AXT Pty Ltd
www.axt.com.au

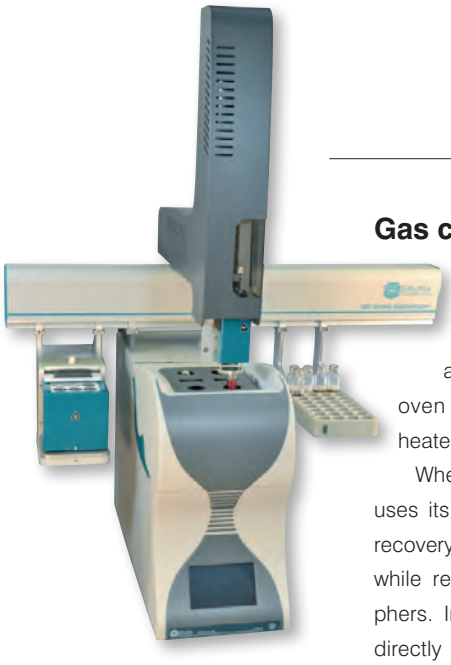
Sequencing systems

The NovaSeq series of systems leverage Illumina next-generation sequencing (NGS) technology. They offer users scalable throughput and flexibility for virtually any sequencing method, genome or scale of project.

Applications requiring large amounts of data, such as human whole genome sequencing (WGS), ultradeep exome sequencing and tumour–normal profiling, can be completed using the series. The same instrument can be used for less data-intensive methods, such as targeted resequencing. Every project, regardless of the size or goal, will benefit from simple load-and-go operation, integrated onboard cluster generation and seamless integration with data storage and analysis tools that help streamline the overall experimental workflow.

Available in two configurations, the NovaSeq 6000 offers tunable outputs up to 6 Tb and 20 billion reads in ~2 days, while the NovaSeq 5000 generates up to 2 Tb and 1.6 billion reads of data in ~2.5 days. Multiple flow cell types and read length combinations enable further output and run time configurations based on project needs, enabling sequencing with rapid results for a wide range of applications.

Illumina Australia Pty Ltd
www.illumina.com



Gas chromatographs

Ellutia Chromatography Solutions has announced the 500 Series gas chromatograph, featuring the ability to perform conventional and fast gas chromatography with an air-blown oven and ultrafast chromatography with directly heated columns.

When operating in conventional GC mode, the series uses its compact air-blown oven and low-energy heat recovery heating system to deliver good performance while reducing energy consumption for chromatographers. In ultrafast mode, metal capillary columns are directly resistively heated, allowing including increased ramp rates and upper temperature limits as well as decreased cooldown times and energy consumption.

All of this combines to reduce cycle times by up to 10 times while only using a fraction of the energy a conventional GC would require, according to the company.

Amscorp Scientific
www.amscorp.com.au

Thermal analysis suite

TA Instruments has announced the Discovery Thermal Analysis Suite, including the Discovery DSC 2500, 250 and 25; the Discovery TGA 5500, 550 and 55; and the Discovery SDT 650 (simultaneous DSC-TGA). The suite features a host of significant innovations, including an app-style touch screen, powerful TRIOS software, a robust autosampler, and automated calibration and verification routines that work seamlessly to improve laboratory workflows and productivity.

The latest member of the product family is the Discovery SDT 650 — a simultaneous DSC-TGA that measures the change in energy as a function of time and temperature, while simultaneously measuring sample weight changes. With a temperature range of ambient to 1500°C, a wide variety of materials can be characterised on the device.

The Discovery SDT 650 comes with innovations such as: Hi-Res TGA for efficient separation of overlapping weight losses; modulated TGA for fast determination of kinetic parameters; and Modulated DSC for easy determination of heat capacity. The 30-position autosampler ensures that both calibrations and experiments can be scheduled and run unattended over the wide temperature range. The Discovery TGA 5500, 550 and 55 measure sample weight changes under controlled conditions of temperature, time and atmosphere. They are used to characterise the thermal stability and composition of a wide range of materials including polymers, elastomers, composites, pharmaceuticals, electronics and inorganics.

The Discovery DSC 2500, 250 and 25 measure change in energy of a sample as a function of time and temperature. They are used for a wide range of applications, including material science, pharmaceuticals, chemistry and studies of biomaterials. They excel in both research environments and production control processes.

TA Instruments
www.tainstruments.com

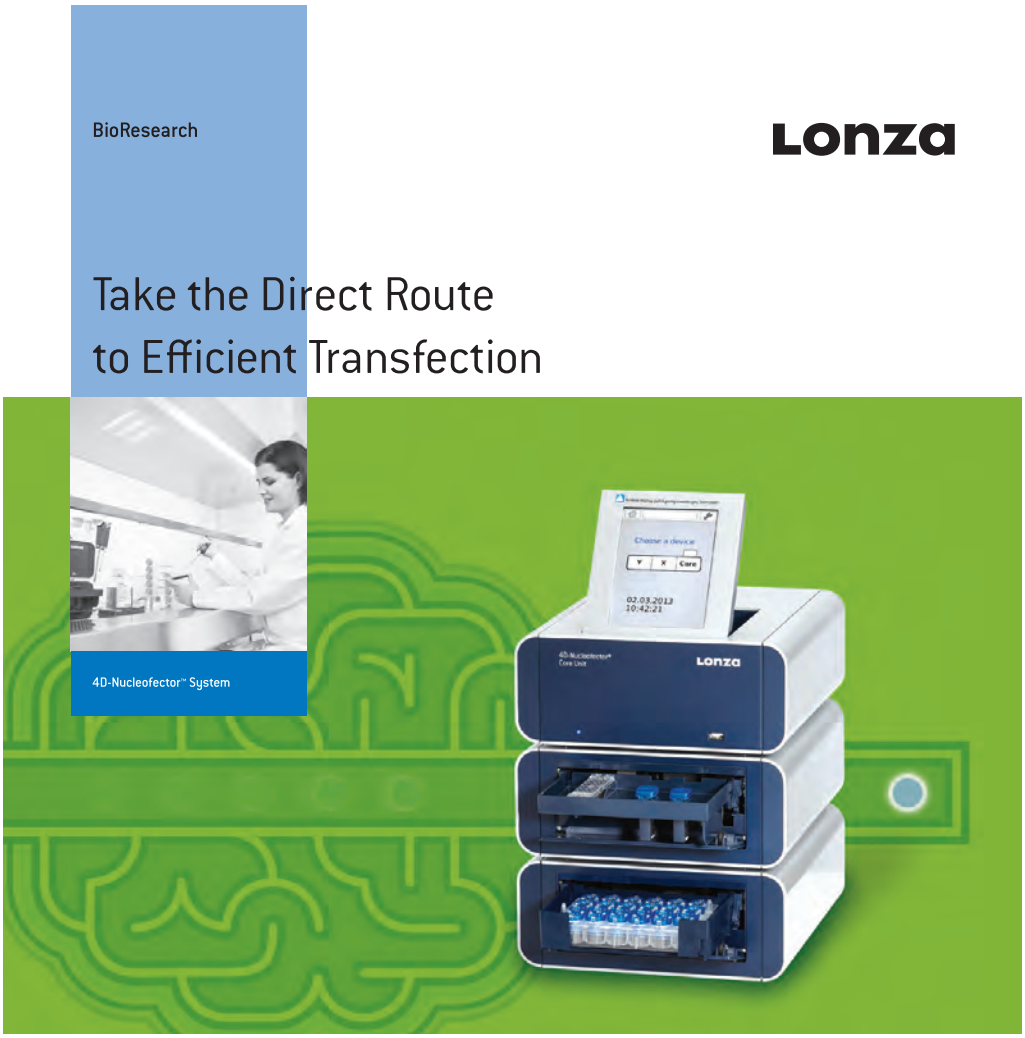
Osmometers

Two osmometers are available from Loser Messtechnik Germany.

The i Osmometer basic can store a sample volume of 100 or 50 μL, with a measuring time of 1.5 min. The i Osmometer basic M can store a sample volume of 10 to 25 μL, with a measuring time of 1.3 min. No extra water supply is necessary.

The products feature icon-style touch operation on a wide, black and white LC display. They include single-use plastic tubes and offer selectable languages and multilevel user access with passwords and usernames. The user has the ability to input sample numbers with the touch display.

Dutec Diagnostics Pty Ltd
www.dutecdiagnostics.net.au



*Martin Wilkinson**

Empowering laboratories of the future

The urgent need for clinical context

Laboratory professionals must have detailed clinical information to make decisions on the most effective testing for patients. We can no longer afford for laboratories to be confined to the back office.

Laboratories across the world still work largely in isolation to clinical providers. Even today, in the digital age of sharing information, a large majority of laboratory professionals are not given the full clinical perspective on the very patients they are carrying out tests for, something that must change with urgency.

Diagnostic functions working within and alongside our health services need clinical context and access to wider sets of information, so that laboratory professionals, like pathologists, can make active and effective decisions on testing and not just rely on inadequate and even sketchy requests from clinical colleagues in different care settings.

It is time to move the laboratory out of the back office, to become a core element of clinical delivery.

Why laboratories do not have the full clinical picture

Laboratories today still often look at their data in isolation. One reason behind this is that information systems have traditionally been niche market solutions specific to the laboratory, meaning that they have become silos of information, locked away from the front line of health care.

Professionals working in diagnostics can only act on information they have, which is

often limited and sometimes even flawed. One major contributing factor to this problem is examination requests themselves, which too often contain handwritten notes that need to be interpreted and then transcribed into the system.

Hindrance too is caused by order systems which present limited information on screen. A professional might see that the patient they are testing for is anaemic, or that they are bleeding from a wound, but they are often not aware of the full clinical picture. So, by being able to provide information on previous testing, along with the patient's clinical symptoms as well as their current drug therapy, this can influence the interpretation of the laboratory results without delays having to be incurred by conducting further investigative processes.

Inappropriate testing and delays in care we cannot afford

As long as the clinical picture is absent from the laboratory, there is the potential for the most relevant testing to be missed within an initial request.

Take the following scenario: the clinician on the ward, or in the clinic, receives the report they requested and realises that they needed to request an additional test. A new test is then ordered. The patient may then need to have another sample taken, which is sent again to the laboratory for retesting. A new report is written and sent to the doctor to make a decision.

This extended process can result in unnecessary increased lengths of stay, delays in clinical decisions and inappropriate repeat tests and samples being taken from patients. When healthcare budgets are under pressure, it is expensive to keep people in beds, it is costly to repeat tests and there is additional burden placed on precious resources that we cannot afford to waste. Most importantly, there is the risk of delay in the diagnosis of the patient.

Doctors can also choose to request a battery of different tests in an attempt to cover everything — leading to further increased cost of care and unnecessary pressure on scarce laboratory resources.

The objective must be to achieve availability of relevant clinical information at the point of analysis and decision-making as quickly as possible.

The right clinical indicators for the right tests

Given the right information, professionals in the laboratory have the expertise to know when tests are needed and when they are not. In a clinical investigation for deep vein thrombosis, for example, the Wells score is used as a guide to assess clinical risk and provide direction on whether additional testing is needed. However, there may be a lack of visibility of the Wells score for professionals in the laboratory.

If they had access to the score, laboratory professionals would be able to make the decision as to whether or not to make those additional tests, at the point the initial sample was received. Instead, they can only perform the tests that have been requested by the clinician, which can result in a cumbersome retesting process.

All of this can be eliminated if that clinical indicator is available to the laboratory at the initial point of testing.

Demand systems and a lack of prompts and guidance for appropriate testing at the point of care can cause similar problems. In the case of a cardiac arrest, for example, there is a need to measure Troponin, and for this and other conditions it is important to use clinical best practice guidelines available as to the indicators for retesting.

However, if the clinician does not have access to guidelines and demand management tools at the point of order, the patient will often have their sample taken multiple times, which the laboratory is then obliged to test. This means that this process is often completed regardless of the potential inappropriate nature of the test, increasing the cost of the clinical laboratory services and use of time and human resources.

We need to build rules into the ordering process, assist clinicians, but most importantly, we need to empower the diagnostic professionals within the laboratory in order to overcome such challenges.

Taking the laboratory out of the back office to the frontline of clinical care

The urgency for change is critical with the increasing demand on our healthcare services. To achieve this we must take laboratory systems away from being islands, a back-office function and a support for clinicians, to a more clinical, front-of-house, engaged clinical service. By creating this change, pathologists can be provided with the information they require, along with clinical indicators, to make decisions as to when appropriate tests are required for patients.

This is about communication between the various points of care, and recognising the diagnostic function as a key clinical contributor. By empowering laboratory professionals with clinical information, we can change who plays a clinical role. This will not only save time, but make the clinical process at the patient point of care more effective.

Evolving sources of information need to be considered too in this changing role of the modern laboratory, as a rapid evolution of point-of-care testing is also taking place. The next generation of laboratory systems must integrate with new care devices and wearable technologies. Wearables can measure a growing range of variables in the human body. If a wearable can be used to measure blood glucose levels, there is no reason why that valuable information should not feed into a diabetic patient's clinical record, for example.

There is finite capacity in the laboratory. If we can stop patients being unnecessarily retested, then the laboratory will have more capacity to focus on core tasks. The consequence is a less stretched environment where both the quality and relevance of the output improves.

Benefits for the patient

Patients too can benefit from placing the laboratory at the centre of care, and not just from the perspective of avoiding unnecessary blood tests. Convenience does play a part, and unnecessary repeat tests can be a hindrance to busy lives. But more importantly, effective intervention often means timely intervention. We want to produce the best outcomes for our patients.

Equally, avoiding any unnecessary distress for patients should be a consideration for any healthcare service. If a patient has a blood test and is called back for another, they can fear the worst in terms of their own health.

Ending the diagnostic disconnect

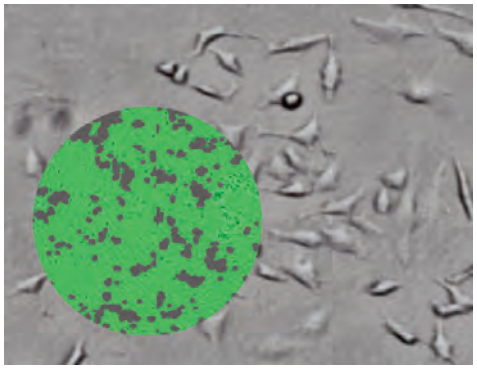
At a time when healthcare services are striving to make savings, improve patient safety and deliver the best outcomes for patients, speedy, efficient and effective laboratory testing is essential. Achieving new models of care means empowering the right people to make the best decisions for patients at every point of care.

To do this, laboratory professionals must have immediate access to the right clinical information to transform diagnostics, so that they can take decisive action for patients at the earliest possible opportunity. The current disconnect between clinical settings and laboratories must end, and this is achievable through the application of new systems and processes that are now available.

Martin Wilkinson is the Sydney-based Director of Product Introduction, Strategy and User Adoption for InterSystems, a global leader in health information technology. Originally trained as a Biomedical Scientist in the United Kingdom, Wilkinson is global head of the company's solutions for the laboratory market.

Intersystems Corporation (Australia)
www.intersystems.com.au

what's new



Multimode reader for live cell assays

Tecan's updated Spark reader combines the benefits of a multimode microplate reader and a brightfield imaging system in a compact package. Unlike other multimode readers, Spark lets users actually see what's happening to their cells, offering automated cell imaging, confluence measurements, cell counting and viability assessments to simplify cell biology protocols and enable long-term, walkaway experiments.

The product has been developed specifically to address the needs of cell-based workflows. It incorporates a host of features — including precise regulation of temperature, gas partial pressures and humidity — to provide an incubator-like environment and maintain optimal assay conditions. The system's Live Viewer function turns a microplate reader into an automated microscope at the touch of a button, allowing the user to instantly image and photograph defined positions in a microplate well.

It offers brightfield microscope-like functionality with 4x magnification and a user-definable focus, providing another way to perform fast and easy quality control of cells before starting an assay. In addition, the cell imaging module offers high-throughput, label-free cell counting and one-click, trypan blue-based cell viability analysis using disposable Cell Chips.

The unit helps to generate reproducible cell-based assay data by allowing the user to continuously monitor cell confluence within the microplate and automatically injects a reagent once a user-defined confluence level is achieved. The system's Fusion Optics combine the flexibility of monochromators with the sensitivity of filters.

Tecan Australia
www.tecan.com.au

Methaniser

Low-level detection of carbon monoxide (CO) and carbon dioxide (CO_2) is critical for many applications. Restek's Methanizer (CH_4izer) for Agilent GCs allows ppb-level determination of CO and CO_2 using an FID instead of other instrumentation.

The product is factory set to 380°C to ensure efficient and complete conversion of CO and CO_2 to CH_4, but the operator can easily adjust the temperature as desired with the touch of a button. The unit controls temperatures precisely to within ±1°C of the defined setpoint and the actual temperature is shown in real time on an easy-to-read display.

The device is designed for easy installation and fast catalyst tube replacement so the user can spend more time analysing samples and less time on maintenance.

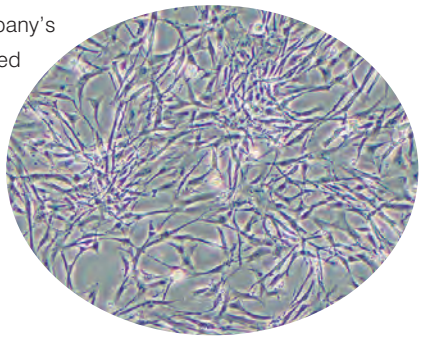
Leco Australia Pty Ltd
www.leco.com.au

IPF airway cells

Lonza now offers cryopreserved lung fibroblasts isolated from donors diagnosed with idiopathic pulmonary fibrosis (IPF) for use in research into this potentially fatal condition. Normal lung fibroblasts and small airway epithelial cells — from both smokers and non-smokers — are also available, offering a complete solution to facilitate IPF and other airway research.

Research into IPF is a rapidly growing field; however, a considerable amount of research is still needed if a cure is to be found, as the pathways of disease progression are not yet understood. Furthermore, IPF tissue has until now been difficult for researchers to source.

By providing IPF cells, Lonza makes it convenient for users to quickly progress with their research. The company's ability to provide primary cells, coupled with detailed donor information, enables researchers to relate donor characteristics to disease progression.



The IPF cells are available together with normal lung fibroblast cells and culture media, providing a complete cell culture solution for IPF research. In addition, the company has the capability to provide custom isolations where required.

Lonza Australia Pty Ltd
www.lonza.com

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Growth media

With the adoption of 3D methods and complex co-culturing becoming a growing trend, cell culture media optimisation has also become a challenging factor for researchers. Lonza helps researchers ease this transition with BulletKit Growth Media, which are robust in supporting co-culture studies.

For cancer research in particular, where both cell lines and primary cells are equally significant, BulletKit Media provides researchers with added flexibility and reduced variability across their experiments as the same media can be used to support the growth of both cell types. This also simplifies experimental design. The MEGM Mammary Growth BulletKit, for example, has been utilised by researchers to support growth of Lonza's primary mammary epithelial cells and breast cell lines, MCF-10A and MCF-12.

For optimal convenience and results, BulletKit Media are available in an all-in-one format which includes basal medium, growth factors, cytokines and supplements.

Lonza Australia Pty Ltd
www.lonza.com

Host device for carbon dioxide probes

Vaisala has launched a host device for GMP251 and GMP252 carbon dioxide probes.

Indigo 201 is a first product in a series of host devices, designed to extend functionalities for the company's existing and future Indigo-compatible probes. It provides an optional display, analog outputs and relays, and a wireless user interface accessed easily by, eg, a mobile phone.

The currently available Indigo-compatible CO_2 probes, GMP251 and GMP252, are designed for harsh and humid environments. They are used in life science incubators, agriculture, cold storages and demanding HVAC applications, such as swimming halls.

The Indigo 201 uses a wireless user interface for easy configuration: users can configure the host using any device with a WLAN connection, such as a laptop, computer or a mobile phone. Temporary viewing of measurement data of the attached Indigo-compatible probe can be done wirelessly.

The host allows for minimal downtime as the probe can be removed and changed to another one. Users can also calibrate the probe with the help of the host device.

The measurement result can be shown on the display or be converted into other formats, eg, analog output signals and for relay activation. These features are useful in various control and monitoring systems. The relays can be used even to build small-scale system to, eg, turn on/off a fan or giving an alarm.

Vaisala Oyj
www.vaisala.com/en/

Brushless DC motor and harmonic gearhead combination with internal encoder

maxon motor's brushless DC 70 W 24 V motor has been combined with the 2048 counts/turn internally integrated encoder and the harmonic lightweight low-profile zero-backlash gearhead. The gearmotor assembly increases the torque and reduces the size of previous solutions using planetary gearbox technology.

Better position capability is now possible with the development of adaptive hardware for the low-profile brushless DC motors and harmonic planetary gearheads. The output capability is 19 Nm repeated and 31 Nm intermittently, while the combination measures just 55 mm in diameter and 59 mm long for all three components.

Having an internal encoder and a zero backlash gear makes the unit suitable for robotic joint and positioning applications in industrial automation, process control and precision laboratory and scientific equipment.

maxon motor Australia Pty Ltd
www.maxonmotor.com.au

Pipette tip

The Biotix xTIP has been manufactured for maximum compatibility with Rainin LTS pipettes. The FlexFit feature allows for a secure seal of the tip onto the pipette without needing to force the fit, improving ergonomics and reducing strain.

The naturally low retentive X-Resin provides a non-stick tip surface, promoting precision when pipetting with no sample loss. Eliminating the need for tip touch off, the Blade feature delivers increased reproducibility.

Available in filtered and unfiltered versions, in sizes of 20, 200 and 1000 µL, the pipette tip also comes with complete certification of RNase-, DNase-, pyrogen-, endotoxin-, nucleic acid- and trace metal-free status.

Interpath Services Pty Ltd
www.interpath.com.au

Multimode microplate reader

The SpectraMax iD3 Multi-Mode Microplate Reader features a large, high-resolution touch screen with embedded software, with no need for a dedicated computer workstation.

Featuring orbital shaking, a four-monochromator optical pathway with high efficiency gratings, well scanning up to a 20x20 read matrix, spectral scanning and detection of plate formats from 6- to 384-well, the reader fits a variety of research needs. Users can run flash applications, such as dual luciferase assays, with the SpectraMax iD3 injector system with SmartInject Technology, ensuring equal mixing for high precision.

A built-in near-field communication (NFC) reader enables the user to start custom protocols with a single tap. NFC tags paired to specific user profiles give direct access to personalised protocols and experimental results.

The optical system includes an ultracooled photomultiplier tube to -5°C, reducing background noise for good sensitivity and dynamic range. A simple-to-use temperature control (ambient to 65°C) supports temperature-sensitive assays.

Data can be viewed quickly on the touch screen, exported to a USB drive or analysed using SoftMax Pro 7 Software. QuickSync technology automatically delivers data to the user's workstation.

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Fluid Technology Group

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Data storage in a drop of DNA

US researchers have come up with a novel method of storing the world's ever-increasing amount of data, turning to a storage technology that humans would quite literally not be able to live without — DNA.

The concept is not an entirely new one, with researchers at the European Bioinformatics Institute (EMBL-EBI) demonstrating in 2012–13 the storage of 739 KB of data in DNA. And according to the authors of the current study, published in the journal *Science*, DNA has all the characteristics to make it an ideal storage medium:

- It is ultracompact — about one million times more so than regular digital media.
- It comes in a liquid state, so it is not bound by the physical limitations of other storage mediums.
- It can last for hundreds of thousands of years if kept in a cool, dry place, as demonstrated by the recent recovery of DNA from the bones of a 430,000-year-old human ancestor found in a cave in Spain.

"DNA won't degrade over time like cassette tapes and CDs, and it won't become obsolete — if it does, we have bigger problems," said study co-author Yaniv Erlich, from Columbia University and the New York Genome Center (NYGC).

Erlich and his colleague Dina Zielinski, an associate scientist at NYGC, chose six files to encode into DNA: a full computer operating system, the 1895 French film *Arrival of a train at La Ciotat*, a $50 Amazon gift card, a computer virus, a Pioneer plaque and a 1948 study by information theorist Claude Shannon. They compressed the files into a master file, and then split the data into short strings of binary code made up of ones and zeros.

Using their own customised version of an erasure-correcting algorithm called fountain codes — originally designed for streaming video on a smartphone — the researchers randomly packaged the strings into so-called droplets, and mapped the ones and zeros in each droplet to the four nucleotide bases in DNA: A, G, C and T. The algorithm deleted letter combinations known to create errors and added a barcode to each droplet to help reassemble the files later.

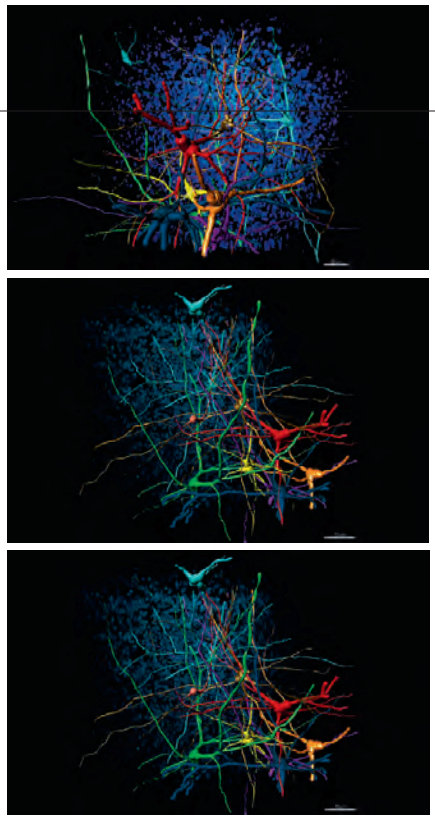
The scientists generated a digital list of 72,000 DNA strands, each 200 bases long, and sent it in a text file to DNA synthesis start-up Twist Bioscience, which specialises in turning digital data into biological data. Two weeks later, they received a vial holding a speck of DNA molecules.

To retrieve their files, the researchers used sequencing technology to read the DNA strands, followed by software to translate the genetic code back into binary. They recovered their files with no errors. They also demonstrated that a virtually unlimited number of copies of the files could be created with their coding technique by multiplying their DNA sample through polymerase chain reaction (PCR) and that those copies, and even copies of their copies, could be recovered error-free.

The capacity of DNA data storage is around 1.8 binary digits per nucleotide base, accounting for the biological constraints of the material as well as the need to include redundant information for reassembly. By applying their version of fountain codes, called DNA Fountain, the researchers ensured the reading and writing process was as efficient as possible. They succeeded in packing an average of 1.6 bits into each base nucleotide — at least 60% more data than previously published methods, and close to the 1.8-bit limit.

The downside of the study was that cost remained a barrier: the researchers spent $7000 to synthesise the DNA they used to archive their 2 MB of data and another $2000 to read it. The price of DNA synthesis may be reduced, however, if lower-quality molecules are produced and coding strategies like DNA Fountain are used to fix molecular errors.

Ultimately, the researchers showed that their coding strategy packs a whopping 215 PB of data on a single gram of DNA — 100 times more than the method published by EMBL-EBI. According to Erlich, this makes it the highest density data-storage device ever created.



3D and 4D image visualisation and analysis software

Imaris is Bitplane's core scientific software module that delivers all the necessary functionality for life sciences data management, visualisation, analysis, segmentation and interpretation of 3D and 4D microscopy datasets.

Combining speed, precision and ease of use, Imaris provides a complete set of features for working with three- and four-dimensional multichannel images of any size, from a few megabytes to multiple gigabytes in size. Users can conveniently load, process and visualise data acquired from almost any microscope.

The latest version, Imaris 8.4, introduces an innovative approach to tracing neuron structures in 3D images of dense neuronal networks like entire brains, organisms or large cleared samples. Torch, a tool which intuitively highlights structures in close proximity to the cursor while darkening the rest of the image, enables users to efficiently and accurately trace individual neurons within dense and thick samples.

Improved depth visibility is said to make tracing in thick samples easier than ever before, allowing for the selection of a dynamic region of interest for tracing. All of this is possible with terabyte-sized datasets.

SciTech Pty Ltd
www.scitech.com.au

Downflow workstations

The DWS range of downflow workstations from Air Science gives operators safety where routine work is being carried out. Units operate at low noise levels and recirculate air, rather than exhaust expensive conditioned air, into the outside environment. This reduces HVAC strain and lowers overhead costs.

The workstations have been specifically designed to provide a small bench-mounted unit with unrestricted access for operations that are difficult to perform in a conventional fume hood. To provide protection, the downflow action takes the contaminated air away from the operator. If airflow falls to an unacceptable level, an alarm will sound.

The main filter can be chosen from 14 different types of carbon, which include specialty media for vapours of organics, solvents, acids, mercury and formaldehyde. HEPA filters for particulate filtration are also available to suit the application.

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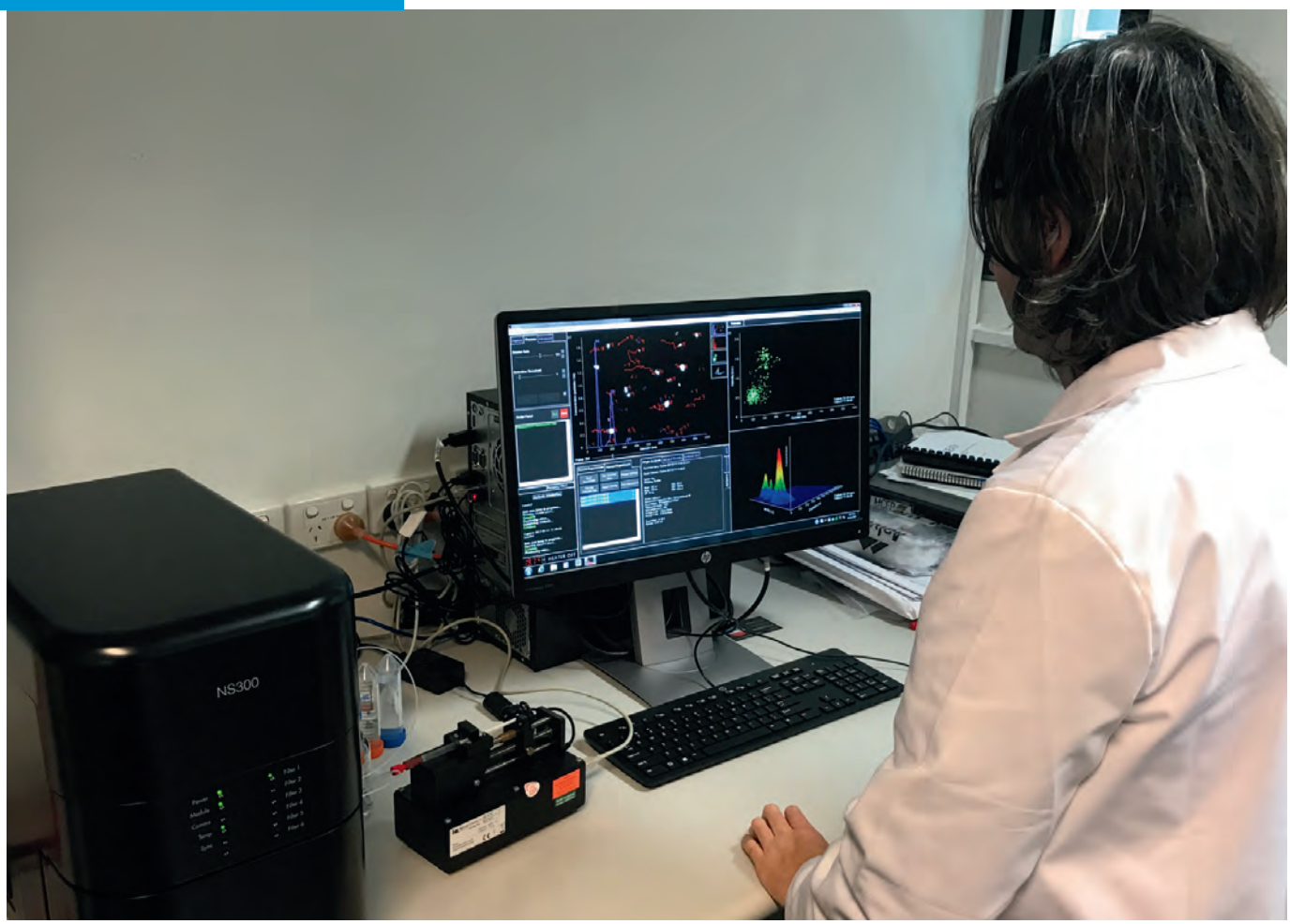


The University of Melbourne boosts its toolkit for nanoparticle analysis with the Malvern NanoSight NS300

The Malvern NanoSight NS300, recently installed within the Materials Characterisation and Fabrication Platform (MCFP) at the University of Melbourne, is providing an easy-to-use, reproducible platform for nanoparticle characterisation.

Aimed to support cutting-edge research in fields such as nanobiotechnology, biomedical engineering and drug delivery, the instrument is now available for all academic researchers and external commercial work.

"The instrument is already being used by researchers from various disciplines and backgrounds including academic, research institution and industrial users," said James Griffith, Acting Platform Manager, MCFP. The range of samples being analysed includes gold nanoparticles, nanoparticles within biological mediums, polymers and extracellular vesicles.

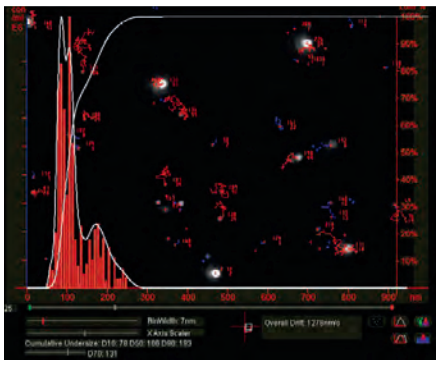
The MCFP supports materials research through advanced instrumentation, analysis and characterisation. The MCFP hosts a number of complementary techniques for particle characterisation, including the recently installed NanoSight NS300. The MCFP welcomes all users across the scientific community.

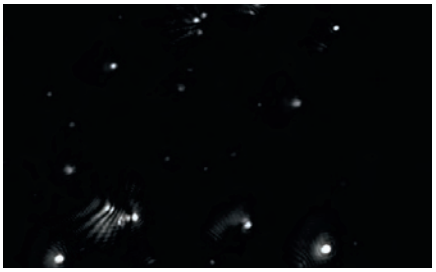
"We decided to purchase a NanoSight to have an instrument that combines the capabilities of multiple instruments in one in order to look at particle concentration and size distribution," said Griffith. "The ease of use and rapid analysis makes the instrument convenient for researchers of all levels and from a broad range of disciplines."

Nanoparticle size analysis

Nanoparticles are playing a growing role across a range of different applications and industries due to their unique properties, such as high surface area to volume and high number. Applications such as viral vaccines, nanobubbles, exosomes, coatings, filtration and the ability to remove pollutants from industrial processes all require an understanding of the different nanoparticle properties to optimise their stability and effectiveness.

There are many techniques available for analysis of nanoparticle size distribution, of which the most common include dynamic





light scattering (DLS), electron microscopy (EM), atomic force microscopy (AFM) and analytical ultracentrifugation (AUC). Although EM and AFM offer information related to particle morphology and size, they can be time-consuming and require a certain degree of previous knowledge of the composition of the material.

Particle size combined with particle light scattering for visual validation

Nanoparticle tracking analysis (NTA) is a relatively new technique based on well-understood principles of sizing. It uses the properties of both light scattering and Brownian motion to characterise individual nanoparticles.

NTA offers the unique capability to visualise, size and count individual nanoparticles in liquid suspension in real time. It is suited for polydispersed systems ranging from 10–30 nm up to 1–2 µm in size (depending on particle type) and is particularly useful for very dilute dispersions. Additional parameters also allow users to acquire information on nanoparticle concentration, relative intensity of light scattered and also to visualise and analyse fluorescently labelled particles.

The NTA technique captures images of the sample particles undergoing Brownian motion in a liquid and obtains size and concentration information using frame-by-frame video image analysis. By measuring the speed of Brownian motion of particles, the nanoparticle diffusion constant can be determined, from which a spherical hydrodynamic diameter can be estimated.

As NTA allows nanoparticles to be simultaneously tracked and analysed on an individual basis, the resulting data is a high resolution particle size distribution analysis in which different materials can be distinguished through their different scattering intensities and, importantly, from which particle concentration can be recovered. As well as particle size distribution and concentration, protein aggregation and viscosity can all be analysed. The unique feature of direct visualisation of the suspension gives the user extra confidence while a fluorescence mode provides detection of labelled particles.

"The fluorescent labelling capability is important for us, and the ability to actually visualise the nanoparticles on a user-friendly interface of NTA software is popular with users," said Griffith.

The NTA technique is fast, robust, accurate and low cost, representing an attractive complement to existing methods of nanoparticle analysis such as DLS or EM.

ISO standard ISO19430

The ASTM E2834–12 method was developed to give guidance to the measurement of particle size distribution by means of NTA. In December 2016, the publication of the long-awaited international standard (ISO19430) particle tracking analysis (PTA) method broadened the scope of the specification. The ISO standard describes the evaluation of the number-based particle size distribution in liquid dispersions (solid, liquid or gaseous particles suspended in liquids) using the particle tracking analysis method for diffusion velocity measurements. The Malvern NanoSight meets all the key deliverables for the new ISO standard and is an essential tool in the lab of the modern scientist.

Booking the NanoSight

The Malvern NanoSight NS300 at the MCFP lab is available for independent use by trained students and staff and is booked on an hourly basis. To become a lab user or to enquire about training, fee-for-service, consultancy work or any other information, contact Paul Brannon (paul.brannon@unimelb.edu.au).

ATA Scientific continues to support customers throughout Australia and New Zealand as it has for more than 27 years. Our dedicated local service team have a long history of providing excellent customer service and support. For more information on the Malvern NanoSight or any other particle characterisation tools, please contact us.

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Olfactometer for behaviour analysis

The multichannel Olfactometer by Phenosys provides fast-response odour stimulation on animals or humans. Applications include olfactory stimulation with pure or mixed odours; concentration gradients or multiple odour mixtures for electrophysiology or imaging studies of olfactory quality coding; investigation of higher cognitive functions using odour; and testing routines for specific human disease models in translational research.

The olfactometer is a sophisticated tool for visualising and quantifying activity in olfactory sensory neurons and the olfactory bulb for investigating olfactory quality coding. The system allows control of multiple stimuli and stimulus concentration.

The preparation of high-quality odour mixtures is a complex process. With the automated olfactometer and its software, this is made a standard laboratory routine that can be used and integrated easily for the behavioural assessment of odour detection and for odour discrimination behaviour.

The product is available in several sizes, with two to eight odours to two to eight different stimulus ports. Custom configurations are possible with up to 20 independent mass flow controllers and 60 to 100 solenoid valves. It can be combined with virtual reality systems such as the Phenosys Jet Ball. It has operant schedule programming on request and can be used with operant systems by third-party vendors.

SciTech Pty Ltd
www.scitech.com.au

Rotary tank cleaning machine

The Alfa Laval TJ40G rotary tank cleaning machine uses a high-impact jet stream to effectively clean tough tank residues and minimise the risk of product contamination. The four-nozzle rotary jet head is said to clean tanks 60% faster than static spray ball technology, which increases production uptime. Because it cleans faster, the device also uses less water and less cleaning agent, thereby reducing operating costs.

The product is capable of handling tough tank residues, as well as solids up to 1 mm in the cleaning fluid, in tank sizes from 50–1000 m^3. This is particularly important for demanding process lines, where both the size and the amount of particles may be recirculated in cleaning media before completing the cleaning cycle.

Not only does the rotary tank cleaning machine provide cleaning of the tank interior, it also cleans itself inside and out. Its hygienic, self-cleaning construction ensures that the flow of the cleaning fluid reaches the exterior surfaces of the rotary jet head, as well as the critical interior components such as all bushings, bearings and inner surfaces. This minimises the risk of product contamination and ensures a high product quality.

A low pressure loss over the machine is said to provide increased cleaning efficiency compared with other tank cleaning machines running at the same inlet pressure. This results in lower cleaning cost as the unit can run at lower pressure/flow compared to other tank cleaning machines. The device complies with Good Manufacturing Practice (GMP).

Alfa Laval Pty Ltd
www.alfalaval.com.au

Jellyfish collagen for cell culture

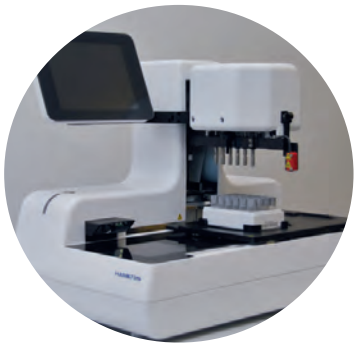
Collagen is abundant in all connective tissue, which makes it one of the most studied biomaterials of the extracellular matrix. Innovation with collagen biomaterials is witnessing significant growth, particularly in the fields of regenerative medicine, medical devices, cell culture and stem cell research.

Jellyfish collagen is an evolutionary ancient chemical template and is where all collagens up the tree of life have been derived. Due to its ancient chemical lineage, jellyfish collagen represents a universal type of collagen, suitable for supporting the growth of a wide range of human cells. It is also human biocompatible, which enables research to be translated from lab to in vivo clinical applications.

Jellyfish collagen is a non-mammalian derived source which is physiologically much less complex than mammals, bony fish and birds (other common sources of collagen), and so there is much less to change between individuals of the species. This provides batch-to-batch consistency, offering advantages to research and medical applications.

Jellagen is a medtech business that manufactures next-generation collagen products sourced from jellyfish for application in 2D and 3D cell culture. The company's products enable researchers and scientists to optimise their study through providing an effective starting material for culturing cells, which allows for more effective representation of human model.

BioNovus Life Sciences
www.bionovuslifesciences.com.au



Sample decapping, capping and identification

Hamilton Storage has announced upgrades to the LabElite DeCapper, I.D. Capper and I.D. Reader for continued workflow efficiencies in tube-based sample management. The products are robust and time-saving tools for applications such as biobanking, forensics, genomics, drug discovery and life science research.

A 6-channel head enables use of 24-well tube racks on the LabElite DeCapper and I.D. Capper in addition to 48- and 96-well tube racks. A variety of internally or externally threaded microtubes, cryovials and specialty tubes, such as those for spit collection, can be rapidly decapped and capped so that laboratories can work with tube volumes and types that are most appropriate for their specific application needs. The compact I.D. Capper adds an extra layer of efficiency and space savings by combining decapping/capping and high-speed 2D barcode reading without the need for additional hardware.

The I.D. Reader features Cold-Scan technology to quickly scan tube racks directly out of a freezer without compromising sample integrity or risking identification errors, effectively combating fog and condensation on barcode scanners. The product automatically decodes 2D barcoded tubes on a wide variety of tube racks, including honeycomb-shaped racks, and also offers automatic rack type detection and optional 1D barcode reading to support efficiency in sample tracking.

Bio-Strategy Pty Ltd
www.bio-strategy.com

Magnetic bead platform

For research involving proteins, purifying and isolating a protein of interest is a key step where time is wasted and results are lost — commonly used magnetic bead protocols involve several 'washing' steps that are slow and harsh, and that can destroy weakly bound and transient protein interactors.

Gilson's Extractman magnetic bead platform uses Exclusion-based Sample Preparation (ESP) technology, which pulls the magnetic beads (along with the attached protein) directly out of solution instead of isolating them with washing steps.

The result is a fast, single-step purifying method that better retains weakly bound protein complexes. Applications from drug discovery to disease pathway research stand to gain from its fast workflows and preservation of end products.

John Morris Scientific Pty Ltd
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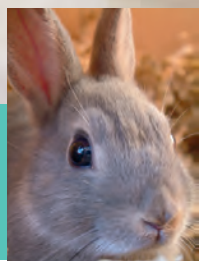
Rabbit virus could treat multiple myeloma

Eric Bartee, PhD. Image credit: Medical University of South Carolina.



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Researchers have taken a novel approach to treating multiple myeloma: the introduction of the rabbit-killing myxoma virus (MYXV).

Multiple myeloma (MM) is a cancer of plasma B cells, a cell type within the immune system. It is the second most common blood cancer and remains difficult to treat. Most patients succumb to disease relapse either from reinfusion of cancerous cells during stem cell transplant or expansion of drug-resistant disease after chemotherapy.

For the past several years, Assistant Professor Eric Bartee has been using MYXV to treat MM in cell culture. MYXV exclusively infects rabbits and is therefore non-infectious to humans. However, Bartee and his colleagues at the Medical University of South Carolina (MUSC) have found that MYXV is able to kill human MM cells.

Stem cell transplants, using a patient's own stem cells, are currently used as a treatment for MM, but patients often relapse from residual cancer cells within the transplant sample. Bartee showed that treatment with MYXV was successful in eradicating MM cells in patients' stem cell samples prior to re-engraftment, thereby preventing relapse of MM.

Bartee and his colleagues recently took this one step further by assessing whether treatment with MYXV also has a benefit on disease outside the context of transplantation. Using a preclinical mouse model, they showed that systemic treatment with MYXV reduced tumour burden and led to a modest decrease in disease progression in 66% of mice. In 25% of mice, there was a complete eradication of disease with no evidence of relapse.

"What I thought was really interesting here was that we could actually get rid of disease and it didn't appear to ever come back," said Bartee, who published the results in the journal *Molecular Therapy — Oncolytics*.

Since MYXV does not replicate in MM cells, it was suggested that eradication of disease was caused by the host's immune system. Investigation of the bone marrow showed that it was unaffected by treatment with MYXV. This suggested that the immune system remained functional and could combat the cancer cells. Indeed, treatment with MYXV led to an increase in $CD8^+$ T cells, a type of white blood cell, within the bone marrow compartment, indicating a strong antitumour response. One advantage of treating MM with MYXV is that the response rate observed in the study is not mediated by the virus — it is actually mediated by the patient's own immune system. Combining MYXV treatment with other immunomodulatory therapies that have been shown to boost antitumour response could provide a novel treatment regimen that improves patient outcome compared to the current treatment model.

Another advantage is that it is extremely difficult for myeloma to develop resistance to killing by MYXV. One of the challenges with standard chemotherapeutic agents is that many tumours often develop resistance through small changes in the cell, leading to relapse of disease. Because MYXV has evolved for thousands of years to override anything the cell can do, there is no real evidence that tumours can develop resistance to oncolytic infections.

But while this preclinical work suggests that MYXV has the potential to cure some patients of MM, there are many hurdles that need to be overcome before this option becomes available — such as large-scale production of a clinical-grade virus and generating a high response rate in humans.

"I think the major next question is 'How do you get that response rate from 25% to 50% to 80% to 100%?'" said Bartee.

Ultra-low temperature freezers

The Panasonic TwinGuard -86°C ultra-low temperature (ULT) freezer satisfies an industry demand for safe, long-term storage for high-valued materials. Two independent refrigeration systems, combined with optional liquid nitrogen or liquid CO2 back-up systems, offer a level of protection claimed to be unmatched in the marketplace.

With two independent refrigeration systems, the freezers maintain a uniform -86°C ultralow-temperature environment. Should one cooling system suffer an unexpected failure, the other circuit will keep irreplaceable samples safely around -70°C until repair can be arranged.

The TwinGuard ULT freezer offers the intelligent ECO Mode, optimising compressor operation to match the freezer's running conditions and minimise energy use. Efficient long-term operation of the freezer is facilitated by the filter-less condenser design, which eliminates the need for routine filter cleaning.

The TwinGuard MDF-U700VX-PE ULT freezer is suitable for storing high-value samples in the biotech and pharmaceutical industries, stem cell research and regenerative medicine, tissue banks and blood transfusion centres, and other clinical and biomedical research facilities.

The MDF-U700VX-PE has an extra-large capacity of 728 L without taking up extra space, due to the VIP Plus high-efficiency vacuum insulation. In addition to reducing energy use, VIP Plus provides typically 24% more storage capacity compared to a conventionally insulated freezer with the same footprint.

Bio-Strategy Laboratory Products
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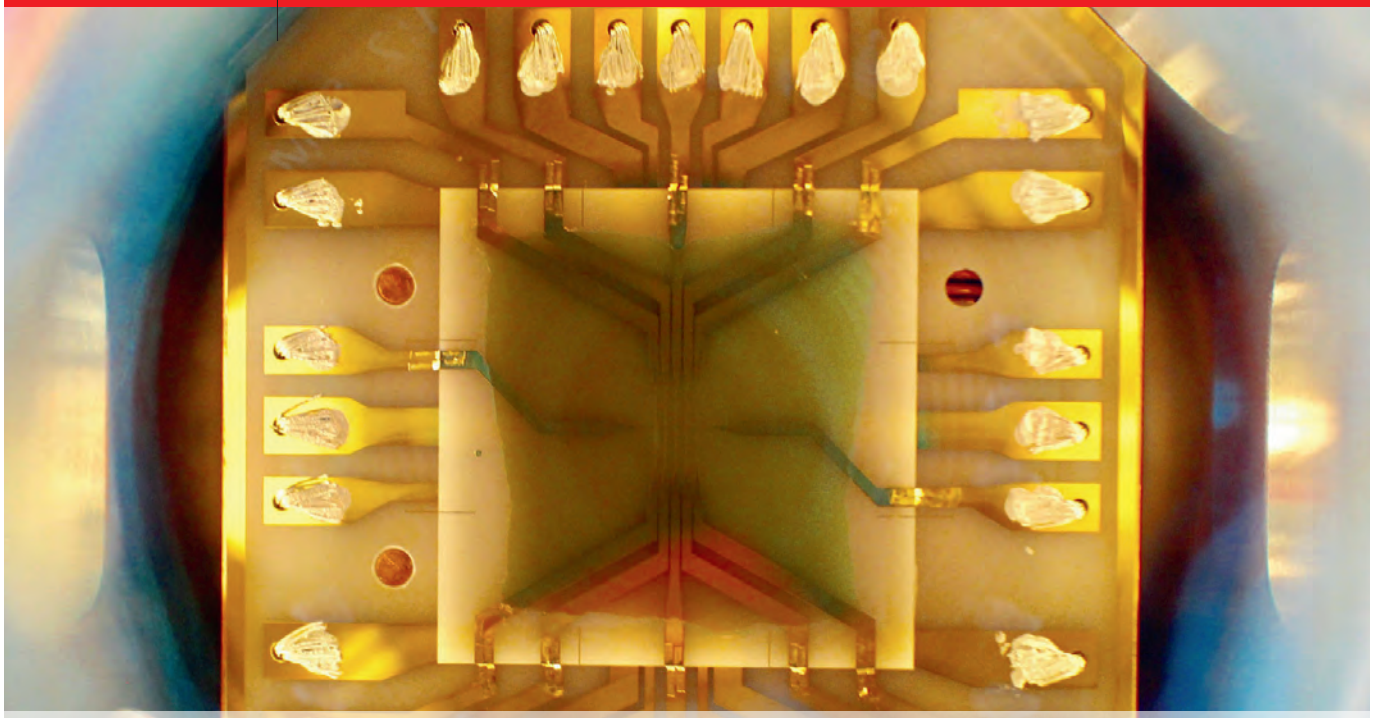


The atom chip of MAIUS 1. Image credit: MAIUS project team/J Matthias

Quantum object created in space

German researchers have successfully created a cloud of ultracold atoms in space — and begun testing a theory of Albert Einstein's in the process.

According to Einstein's Equivalence Principle, all bodies are accelerated at the same rate by the Earth's gravity, regardless of their properties. Under conditions of microgravity, very long and precise measurements can be carried out to determine whether different types of atoms do indeed fall equally fast.

As part of a national consortium, researchers from Germany's Ferdinand-Braun-Institut, Leibniz-Institut fuer Hoechstfrequenztechnik (FBH) and Humboldt-Universitaet zu Berlin (HU) set out to test the Equivalence Principle in quantum objects. The MAIUS 1 (Matter-Wave Interferometry in Microgravity) experiment saw the researchers generate a cloud of nano-Kelvin cold rubidium atoms aboard a sounding rocket launched — a cloud which was cooled down with laser light and radiofrequency electrical fields so that the atoms finally formed a single quantum object called a Bose-Einstein condensate (BEC).

To produce a BEC, a cloud of atoms must be cooled down to absolute zero, or -273°C. In a two-phase process, the movement of the atoms must first be decelerated using lasers — because the faster an atom moves, the higher its temperature. After the laser beams slow down the atoms, the particles are then loaded into an atomic trap from which they cannot escape. This trap is created by means of an atom chip on which magnetic fields are generated; the magnetic containment can be thought of as the 'walls' of the trap.

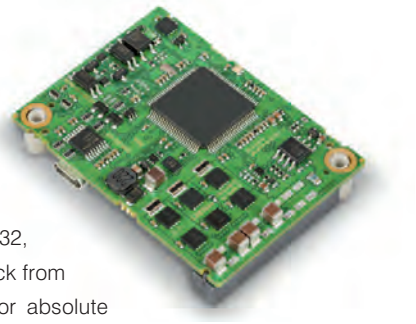
After laser cooling, the second phase of the temperature reduction begins in the magnetic trap. During this, the magnetic field is reduced, so that the height of the walls is reduced. Consequently, only the coldest and hence most motionless particles remain in the trap, while the more mobile atoms can surmount the lower barrier.

The parameters of the experiment meant the FBH had to develop hybrid micro-integrated semiconductor laser modules that were suitable for application in space. Additionally, scientists from 11 German research facilities spent several years working to miniaturise the BEC technology to fit into the payload module of a sounding rocket around 2.5 m high and 50 cm in diameter. This was easier said than done, given that such technology normally takes up an entire room!

"Designing a system so compact and robust that it can fly on a sounding rocket has been a major challenge for scientists and engineers," admitted Stephan Seidel, scientific leader of MAIUS 1 from Leibniz Universität Hannover.

The rocket was finally launched from a facility in northern Sweden on 23 January, with around 100 individual interferometry experiments carried out during the six-minute microgravity phase of the flight. The system was said to work perfectly in space and remains fully operational even after experiencing huge mechanical and thermal stress caused by the rocket launch.

This is just as well for the researchers, as two further missions — MAIUS 2 and 3 — are set to follow in 2018 and 2019. In MAIUS 2, in addition to ultrapure rubidium atoms, ultracold potassium atoms will be used on a sounding rocket for the first time. With MAIUS 3, the falling velocity of BEC from both atomic species is to be compared via interferometry. It is this final experiment that will test the Equivalence Principle, which lies at the heart of Einstein's General Theory of Relativity.



Motion controller for DC motors

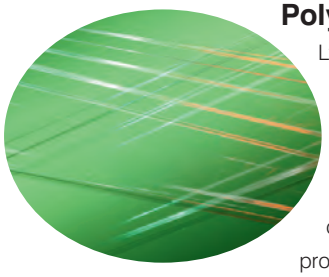
Available on request is the EPOS4 24/1.5 DC motor control module. Weighing just 17 g and measuring 39 x 54 mm, the position controller can also control both brushed DC motors and brushless DC motors (BLDC motors).

The product retains the full motion control capabilities of larger controllers, including RS232, USB, CanOpen and EtherCAT communications onboard or via adaptor modules. Feedback from the DC or BLDC motor is achieved using either hall sensors, incremental encoders or absolute encoders. It can be used with current/torque control, closed-loop speed control and position control.

Designed primarily for use on 12 or 24 V systems, the controller is based on a high PWM frequency of 100 kHz for adaption with highly dynamic ironless and coreless DC motors that have low inductance levels. Current limiting, overcurrent, overtemperature, undervoltage, overvoltage and short circuit protective functions are all included.

Free set-up software for auto configuration and tuning of motors is supplied, along with programming examples for PC, PLC, LabView and Linux environments. IEC61800-5-2 based Safe Torque Off (STO) makes the controller suitable for use in critical applications such as manufacturing processes and collaborative robotics.

maxon motor Australia Pty Ltd
www.maxonmotor.com.au



Polypropylene resin

LyondellBasell has introduced Purell RP320M, a polypropylene (PP) random copolymer that can be used in caps and closures, labware, flexible and rigid packaging of medical devices and pharmaceuticals. The product offers good clarity and homogeneity to meet high-quality requirements in cast film extrusion conversion and injection-moulding technologies.

The resin exhibits low gels content, which contributes to end applications that require optical properties such as gloss, transparency, surface smoothness, planarity and tear resistance. It can achieve good sealing properties in film structures and its rheology behaviour offers good processability for injection-moulded applications. It does not contain slip or antiblocking additives and it is manufactured using a non-phthalate-based catalytic system.

The PP grade is backed by LyondellBasell's Purell Service Concept for healthcare applications, which offers consistency of formulation, continuity of supply, single sourcing and compliance to regulatory requirements.

LyondellBasell Australia PTY Ltd
www.lyondellbasell.com.au

Simultaneous DSC/ TGA instrument

The latest member of TA Instruments' thermal analysis product family is the Discovery SDT 650 — a simultaneous DSC/ TGA instrument that measures the change in energy as a function of time and temperature while simultaneously measuring sample weight changes.

At the core of the instrument is the company's dual-beam thermobalance. The integrated thermocouple design within the ceramic beams provides sample, reference and differential temperature measurements. It comes with Hi-Res TGA, Modulated TGA and Modulated DSC.

An innovative gas delivery manifold allows gas switching and mixing of up to four gases. Dual-sample mode doubles throughput over any other TGA. A linear 30-position autosampler is available.

The Discovery series is the latest release in TA Instruments' range of thermal analysers, rheometers and thermal diffusivity and conductivity analysers.

TA Instruments
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Circular dichroism spectrometers

Chirascan circular dichroism spectrometers incorporate innovative optical design features to maximise light throughput, particularly in the far-UV wavelength region, and a sophisticated digital data acquisition system that facilitates the rapid collection of precise CD spectra.

The product's digital CD spectra acquisition approach ensures that unmodified CD spectra are collected and any post-acquisition smoothing of the CD spectra will be non-distorting and completely reversible. This approach also simplifies the operation — the unit is as straightforward to use as a single-beam spectrophotometer. The product is able to collect thermal denaturation CD spectra in a single experiment, enabling identification of the secondary structural changes associated with each phase transition. Rapid and efficient nitrogen purging, combined with a sealed monochromator housing, ensures that just 5 L/min of nitrogen are required for far-UV work.

The unit features five detection channels — CD, absorbance/transmission, HT, temperature and voltage — with simultaneous multichannel data acquisition ensuring that all key information is recorded with every measurement made. The detector position is easily adjustable and can be set close to the cell to optimise performance with highly scattering samples, eg, membrane proteins.

A large range of accessories is available, ensuring the researcher can be confident of an effective and futureproof spectrometer that can be adapted as research interests evolve.

Scientex Pty Ltd
www.scientex.com.au

Particle size analyser

Malvern Instrument's Mastersizer 3000 uses laser diffraction for non-destructive automated particle size distribution measurements. It offers a broad measurement range, sample flexibility and fast data acquisition. With a dynamic range spanning 0.01 to 3500 μm, the Mastersizer 3000 delivers precise, robust, wet and dry particle size measurements tailored to the operator's specific application needs.

The product can be combined with a range of dispersion accessories that are said to open up more applications than ever before. The Hydro Sight is a lens-less dynamic imaging accessory that supports method development and troubleshooting by providing real-time visualisation and assessment of liquid particle dispersions.

The Mastersizer 3000 software guides users through every stage of a measurement, from method development to result reporting, reducing training requirements and making particle size measurement fast and routine.

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A scientific Swiss Army knife

US chemists have developed a powerful method of selectively linking chemicals to proteins, in an advance that could transform the way drugs are developed, proteins are probed and molecules are tracked.

The new technique, called redox activated chemical tagging (ReACT), was developed at the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab). It is believed that it could fundamentally change the process of bioconjugation — the process by which chemicals and tags are attached to biomolecules (particularly proteins). F Dean Toste, who co-led the study, compared bioconjugation to hitching cargo onto the back of a pickup truck.

"That cargo can be used for many purposes," he said. "It can deliver drugs to cancerous cells or it can be used as a tracking device to monitor the truck's movements. We can even modify the truck and change it to an ambulance. This change can be done in a number of ways, like rebuilding a truck or putting on a new hitch."

Bioconjugation traditionally relies on the amino acid cysteine, often used as an attachment point for tags and chemical groups because it is one of two amino acids that contain sulfur. This provides an anchor for acid-based chemistry and makes it easy to modify. But cysteine is often involved in the actual function of proteins, so 'hitching cargo' to it creates instability and disrupts its natural function.

Seeking to circumvent cysteine, scientists have typically turned to methionine — the only other sulfur amino acid available. A key benefit of methionine is that it is a relatively rare amino acid, which allows researchers to selectively target it with fewer side effects and less impact on the biomolecule.

However, methionine has an extra carbon atom attached to its sulfur, which blocks most hitches. The Berkeley researchers developed a new hitch using a process called oxidation-reduction chemistry, which allows cargo to be hitched to the methionine sulfur with this extra carbon still attached.

The team put ReACT to the test by synthesising an antibody-drug conjugate to highlight its applicability to biological therapeutics. They also identified the metabolic enzyme enolase as a potential therapeutic target for cancer, showing that the tool could help home in on new targets for drug discovery. Their results have been published in the journal *Science*.

"We've essentially invented a new type of chemical Swiss army knife for proteins — the first that can be used for the essential and naturally occurring amino acid methionine," said principal investigator Christopher Chang. "This ReACT method can be incorporated into a variety of different tools depending on what you need it to do. You can mix and match different reagents for a variety of applications."

In the long term, the researchers said, this new bioconjugation tool could be used in:

- nanotechnology, where protein conjugation can help make nanomaterials compatible with air and water, reducing toxicity;
- the creation of artificial enzymes that can be recycled, have better stability and have improved activity and selectivity through chemical protein modification; and
- synthetic biology, where it can be used to selectively make new proteins or augment the function of existing ones.

"This method could also add to the functionality of living organisms by directly modifying natural proteins to improve their stability and activity without making a genetically modified organism that relies on gene editing," said Chang. "It could have implications for the sustainable production of fuels, food or medicines, as well as in bioremediation."

Mass flow meter and mass flow regulator

Mass Flow ONLINE has announced the release of the MV-108 mass flow meter and MV-308 mass flow regulator. With the introduction of these models, the MASS-VIEW product line has been extended to gas flow rates up to 500 L_n/min (N_2-equivalent), fulfilling the demand from industrial users for gas supply in, eg, burner applications, chemical processes and systems in the food and beverage industry.

The instruments provide local display, as well as an electronic output signal, and feature an accuracy of ±1% RD plus ±0.5% FS up to 250 L_n/min and ±2% RD for higher flow rates. Both models have four pre-installed ranges (100%, 40%, 20% and 10% of maximum FS range) selectable via a user-friendly menu using a four-way navigation button. The user can easily select one out of the 10 pre-installed gases — air, N_2, O_2, Ar, CO, CO_2, N_2O, CH_4, C_3H_8 and C_4H_{10} — which eliminates the need to recalibrate for different gases. The maximum operating pressure is to 10 bar(g)/150 psi(g).

Anri Instruments & Controls Pty Ltd
www.anri.com.au

Temperature control of exothermic reactions

The DrySyn SnowStorm ONE from Asynt is designed to provide temperature control of exothermic reactions.

The unit accommodates single round-bottomed reaction flasks from 50 to 1000 mL. Interchange of reaction flasks is easy and takes just seconds without disrupting the circulation fluid, as is required when using jacketed reaction vessels.

Operated with a suitable recirculating thermostat system, the product allows users to precisely set and control reaction temperature anywhere between -30 and +160°C. The ability to precisely control a temperature ramp makes it particularly of interest to polymorph studies. Optional insulation helps to improve performance and keep the apparatus ice-free when operating sub-zero. The stable controlled performance means that even overnight reactions can be performed with complete confidence. The product is offered with a choice of magnetic hotplate stirrer or with an overhead stirrer when more viscous samples are encountered.

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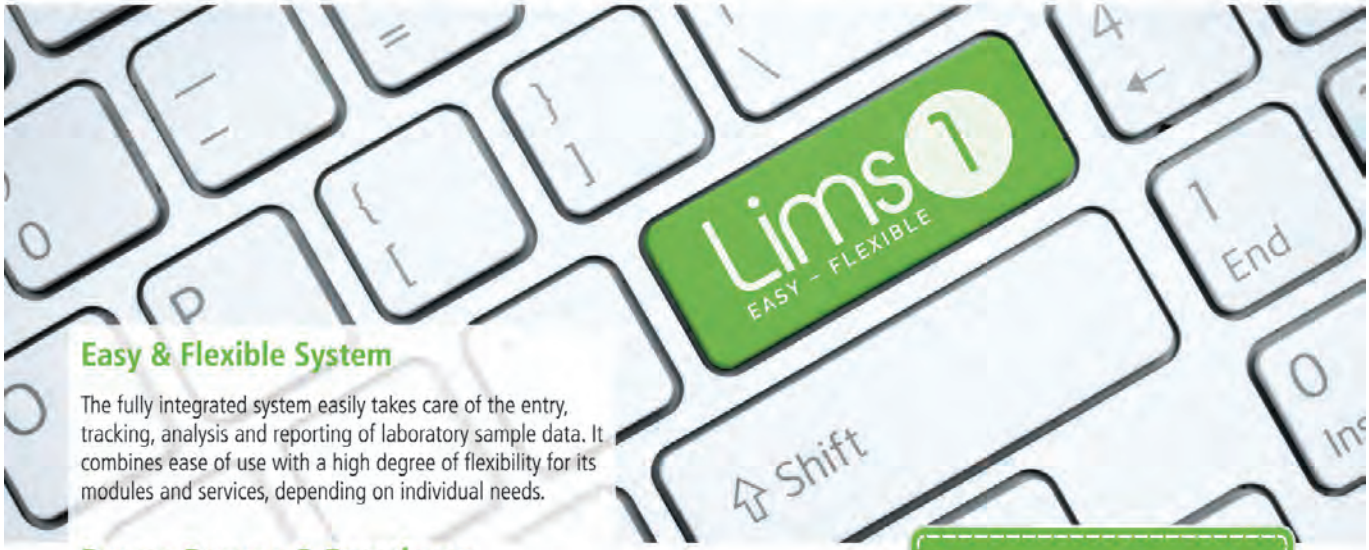

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Mercury porosimeter

The Autopore V mercury porosimeter, from Micromeritics, is based on the intrusion of mercury into a porous structure under stringently controlled pressures.

Besides offering speed and a wide measurement range, mercury porosimetry permits users to calculate numerous sample properties such as pore size distributions, total pore volume, total pore surface area, median pore diameter and sample densities (bulk and skeletal). The instrument also features safety features and offers data reduction and reporting choices that provide more information about pore geometry and the fluid transport characteristics of the user's material.

The system is available in two models: the 9605 with four low-pressure ports and two high-pressure ports at 33,000 psia; and the 9620 has four low-pressure ports and four high-pressure ports at 60,000 psia. It operates in scanning and time- or rate-of-intrusion equilibrated modes and collects high-resolution data — better than 0.1 μL for mercury intrusion and extrusion volume.

Research applications include pharmaceuticals, ceramics, adsorbents, catalysts, aerospace, fuel cells, geoscience, filtration, construction materials, paper and medical implants.

Particle & Surface Sciences Pty Ltd
www.pss.aus.net

Chilling/heating dry bath

Torrey Pines Scientific announces its EchoTherm Model IC50 — a Peltier-driven chilling/heating dry bath with exact sample temperature control.

The unit is supplied with a temperature probe to insert directly into the sample or into the sample block. The probe senses the sample temperature or sample block temperature directly and sends that information to the unit to drive and control the temperature exactly where set. There is also a sensor in the heater plate for allowing the user to set the plate temperature and use the probe to monitor the sample temperature.

The product displays and controls temperature to ±0.1°C. It can freeze, chill or heat samples from -10 to 110°C in assay plates, centrifuge tubes of all sizes, vials, test tubes and most other sample containers. It is particularly suited to the molecular biology lab for doing hybridisations, sample prep for PCR, ligations, enzyme reactions and deactivations and more.

The bath has a digital display and control of temperature to 0.1°C; a countdown timer in days, hours, minutes and seconds to 30 days; a surface hot indicator lamp; a data logger; and an RS232 I/O port to control the unit by computer or to record data. It comes complete with a 100 W chiller/heater module, a universal power supply, an AC line cord and instructions. It is UL, CSA and CE compliant.

Edwards Group Pty Ltd
www.edwardsco.com.au

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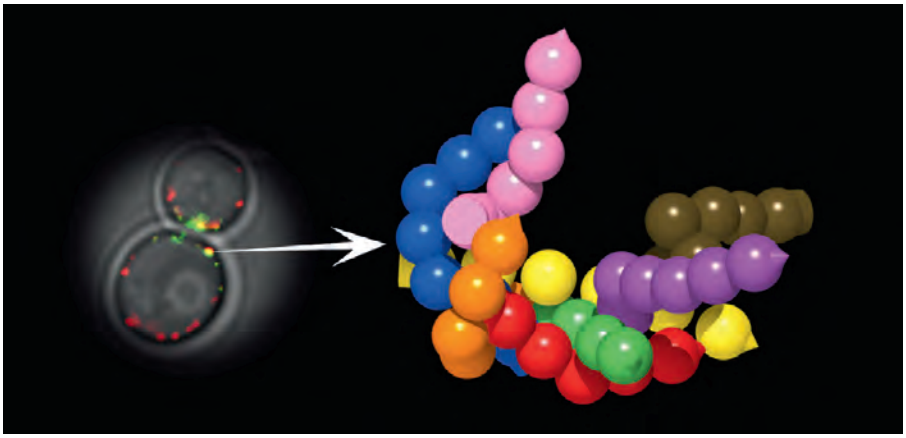
Better in 3D

Nanomachines observed in living cells

Through a combination of genetic engineering, super-resolution microscopy and biocomputation, European researchers have been able to observe protein nanomachines in living cells in 3D.



On the left, an in vivo image of nanomachines using current microscopy techniques; on the right, the new method allows 3D observation of nanomachines in vivo and provides a 25-fold improvement in resolution. Image credit: O Gallego, IRB Barcelona.

Also known as protein complexes, protein nanomachines are the structures responsible for performing cell functions. Currently, biologists who study the function of these complexes isolate them in test tubes, divorced from the cell, and then apply in vitro techniques that allow them to observe their structure up to the atomic level. They can also analyse these complexes within the living cell, but that provides little structural information.

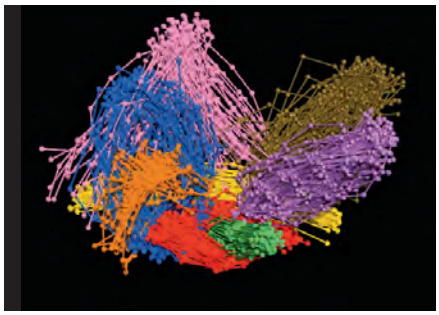
"The in vitro techniques available are excellent and allow us to make observations at the atomic level, but the information provided is limited," said Oriol Gallego, who coordinated the study group. "We will not know how an engine works if we dissemble it and only look at the individual parts. We need to see the engine assembled in the car and running."

Seeking a solution, Gallego and his colleagues at IRB Barcelona, in collaboration with the University of Geneva and the Centro Andaluz de Biología del Desarrollo, developed a strategy that brings together methods from super-resolution microscopy, cell engineering and computational modelling. Their work was published in the journal *Cell*.

The scientists began by genetically modifying cells in order to build artificial supports inside onto which they could anchor protein complexes. These supports would allow the researchers to regulate the angle from which the immobilised nanomachinery was viewed.

Then, in order to determine the 3D structure of the protein complex, they used super-resolution techniques to measure the distances between different components and then integrate them in a process similar to that used by GPS.

The method enabled the researchers to observe protein complexes with a precision of 5 nm — a resolution four times better than that offered by super-resolution, according to Gallego. By directly observing the structure of the protein machinery in living cells while it is executing its function, the scientists have enabled cell biology studies that were previously unfeasible.



Model of the architecture of the main machinery involved in exocytosis. The eight proteins, each shown in a different colour, are bound, forming the nanomachine. Image credit: O Gallego, IRB Barcelona.

Gallego has already used the method to study exocytosis, a mechanism that the cell uses to communicate with the cell exterior. He and his colleagues have now revealed the entire structure of a key nanomachine in exocytosis that was until now an enigma.

"We now know how this machinery, which is formed by eight proteins, works and what each protein is important for," said Gallego. "This knowledge will help us to better understand the involvement of exocytosis in cancer and metastasis — processes in which this nanomachinery is altered."

Furthermore, an understanding of how nanomachines carry out their cell functions has biomedical implications, since alterations in their inner workings can lead to the development of diseases. The new strategy could therefore make it possible to see how viruses and bacteria use protein nanomachines during infection, as well as better understand the defects in complexes that lead to diseases in the first place.

Gallego said the ability to see 5 nm protein complexes is "a great achievement", though he added that there is "still a long way to go to be able to observe the inside of the cell at the atomic scale that in vitro techniques would allow".

"I think that the future lies in integrating various methods and combining the power of each one," he said.

Centrifugal sample concentrator range

Genevac has announced the second generation of its miVac centrifugal sample concentrator range.

The product incorporates an improved pressure controller with intuitive programming and graphical display, making it even easier to use. It also features solid aluminium JetRotors, enabling high-speed evaporation.

The concentrators are suitable for use with a wide range of solvents, from volatile organic types through to water and many medium boiling point solvents. Capable of removing solvents from a variety of sample formats, including tubes, microplates and vials, they can also be used to freeze dry aqueous samples. There is a choice of three medium to high vacuum pumps and a dedicated DNA system with built-in pump.

The concentrators feature built-in special methods for working with alcohols, water and water mixtures to improve performance and optimise concentration times. They also feature SpeedTrap — a frost-free, refrigerated cold trap that minimises the traditional time required to dispose of removed solvent.

The concentrators are quiet when in use and are said to be up to 40% faster than comparable biological sample concentrators.

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Reference material

The Starna Green reference material can be used to qualify the absorbance and wavelength scales of spectrophotometers in the ultraviolet and visible regions of the spectrum (250–650 nm). It was specially developed for use with instruments with wider bandwidths (up to 20 nm), but is a useful general-purpose reference for all instruments.

The use of aqueous dye solutions is an established and well-recognised method for the validation of the absorbance scale and linearity of a spectrophotometer. Starna Green is a specially formulated dye solution with three broad but well-defined peaks that can be certified for both wavelength and absorbance value in the UV and visible regions, at bandwidths up to 20 nm.

The reference is available at four increasing concentrations, with nominal concentration values of 25, 50, 75 and 100.

Starna Pty Ltd
www.starna.com

Sample preparation system

The FastPrep-24 5G is part of the FastPrep family of sample preparation systems for the isolation and purification of high molecular weight genomic DNA, functional RNA and biologically active proteins, metabolites and other small molecules. Developed for difficult samples, the high-speed, benchtop reciprocating instrument utilises bead-beating technology to deliver complete and quantitative grinding, lysis and homogenisation for all types of biological samples.

The product's enhanced, omnidirectional motion mechanically disrupts cells through the simultaneous impaction of lysing matrix particles, eliminating the need for chemicals, enzymes and detergents which can inhibit downstream processes. Samples include but are not limited to: all types of human, animal and plant tissues, including cultured cells; bacterial and fungal cells, including spores and oocytes; and environmental and metagenomic samples, including soil and faecal samples.

MP Biomedicals' wide range of lysing matrix compositions is optimised by sample type, ready to use and certified nuclease-free. The company's complete purification kits include all necessary buffers and the lysing matrix tubes. Eleven optional, interchangeable sample holders offer flexibility in throughput and sample size. Sample tube sizes of 2, 4.5, 15 and 50 mL allow processing under ambient or cryogenic conditions.

The sample preparation system delivers rapid, reproducible, high-yield extractions of fully intact, biologically functional macromolecules from any routine or resistant sample in 40 s or less. Its touch-screen programming and microprocessor controls include >70 recommended protocols for a wide variety of sample types: just load sample and press start. User-created custom protocols can be saved to memory.

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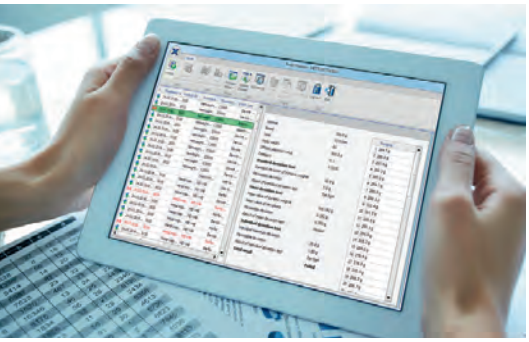
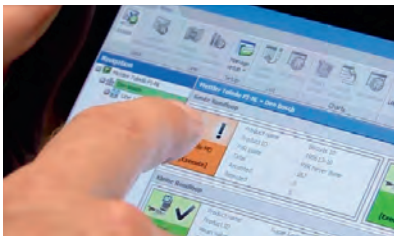


Data management software system

Mettler-Toledo Product Inspection has launched the ProdX 2.0 data management software system. Designed for use on food lines, as well as in pharmaceutical and chemical processing, the software package connects product inspection equipment across the entire production line into a single, unified network. In doing so, it is able to collect in-depth data about productivity and product quality issues, such as foreign body contamination, and access it in real time from one centralised location. The system not only records the date, time, location of the reject and the reason for removal, it enables manufacturers to store verifying documentation about the active managerial control measures taken to prevent incidents reoccurring in the future. This ensures compliance with a wide range of international food standards as well as pharmaceutical and product quality guidelines. The product is able to manage data from a wide range of product inspection machines, including X-ray systems, metal detectors, checkweighers and vision inspection equipment. It is even capable of storing X-ray and vision inspection images of rejected packs to allow further analysis of rejection incidents by operatives at a later date.



Featuring a standardised OPC Unified Architecture (OPC UA) server interface, and able to support PackML tags, the software can be seamlessly integrated into existing production line networks. This enables the software to collect data about the performance of all the inspection machines on the production line, from throughput speed to instances of product over- or under-fill, enabling the calculation of the overall equipment effectiveness (OEE) of the manufacturing process by the company's control and MES system. The product is available as a turnkey starter pack that can be easily installed on standard-sized production lines and existing network equipment, as well as an expandable base pack that can be scaled to manufacturers' specific size and connectivity needs.

Mettler-Toledo Ltd
www.mt.com

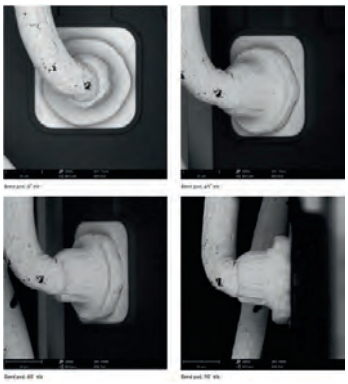
Triple quadrupole ICP-MS system

Laboratories working with challenging matrices can now benefit from a triple quadrupole inductively coupled plasma mass spectrometer (ICP-MS) that is designed to combine power and simplicity in a single instrument. The Thermo Scientific iCAP TQ ICP-MS is an easy-to-use system developed to support ultralow detection limits, and it offers interference removal capabilities designed to overcome interferences common in challenging matrices. It is also designed to provide reproducible data for a range of applications.

The product allows users to switch between single and triple quadrupole modes in a single multi-element experiment so that laboratories can keep their existing workflow as well as add more capabilities over time. When combined with Thermo Scientific Qtegra Intelligent Scientific Data Software, an intuitive user interface and the Reaction Finder tool, researchers can reduce time-consuming method development.

The system requires minimal user maintenance and includes QCell flatapole technology, a small volume collision/reaction cell with flatapole rods, and a dedicated gas distribution unit for lab safety and flexibility. It also features self-aligning sample introduction components for reproducibility and an ergonomic benchtop design with a compact footprint that saves valuable lab space. By integrating control of peripherals, the system is designed for high productivity with minimal errors.

Thermo Fisher Scientific
www.thermofisher.com.au



Sample rotation and tilting

The Eucentric Sample Holder, from Phenom World, allows users to quickly and safely tilt and rotate samples while imaging on a desktop SEM. The holder allows both eucentric tilting and compucentric rotation, which means users can move samples around quickly and easily without losing sight of the sample detail. The 6-axes substage is fully integrated into a regular Phenom XL sample holder, so it can be simply loaded or unloaded within 1 min.

Instead of the traditional optical cameras and touch sensors, the holder's stage uses anticollision algorithms combined with clever engineering to keep both samples and the SEM safe. A real-time 3D visualisation module shows the actual sample position and orientation at all times, from any position the user chooses. Samples can be tilted up to angles of 90° without risk of collision, enabling worry-free operation.

ATA Scientific Pty Ltd
www.atascientific.com.au

Food testing guide

Phenomenex announces the publication of a food testing guide to help the industry meet increasing demands for quality and safety testing and adhere to the guidelines of the Food Safety Modernization Act (FMSA).

The 160-page guide presents more than 150 applications using HPLC, LC/MS, UHPLC/MS, GC, GC/MS and sample preparation techniques and covers a wide range of compound classes, including contaminants, mycotoxins, pesticides, veterinary pharmaceuticals, sugars, dietary supplements and vitamins, along with GC tools for fast fatty acids analysis.

The guide includes useful tools and resources to help analysts select the most appropriate technique for any sample type. It also addresses methods for challenging matrices such as animal feed, seafood, dairy products, bread and wheat products, and meat. The guide is available to view or download from the Phenomenex website.

Phenomenex Australia
www.phenomenex.com

Photo by Jonathan O'Neil

World's oldest fossils uncovered

An international research team has discovered the remains of microorganisms at least 3.77 billion years old, making them the oldest fossils ever found.

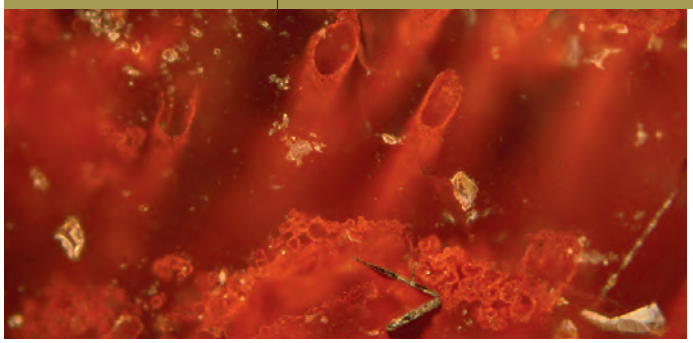
Photo by D.Papineau.

In a study led by University College London (UCL), researchers discovered tiny filaments and tubes, formed by bacteria that lived on iron, encased in quartz layers in the Nuvvuagittuq Supracrustal Belt (NSB), Quebec. The NSB contains some of the oldest sedimentary rocks known on Earth, which likely formed part of an iron-rich deep-sea hydrothermal vent system that provided a habitat for Earth's first life forms between 3.77 and 4.3 billion years ago.

Collaborating with researchers from the Geological Survey of Norway, the US Geological Survey, the University of Western Australia (UWA), the University of Ottawa and the University of Leeds, the UCL team sought to determine whether the newly discovered fossils definitely had biological origins. This was in part due to a controversial microfossil discovery that took place in Western Australia some years ago, which some scientists suspected to be non-biological in nature.

The research team systematically looked at the ways the tubes and filaments, made of haematite — a form of iron oxide or 'rust' — could have been made through non-biological methods such as temperature and pressure changes in the rock during burial of the sediments. Writing in the journal *Nature*, they stated that all such possibilities were unlikely.

Furthermore, the haematite structures have the same characteristic branching of iron-oxidising bacteria found near other hydrothermal vents and were found alongside graphite and minerals like



Haematite tubes from the NSB hydrothermal vent deposits that represent the oldest microfossils and evidence for life on Earth. The remains are at least 3.77 billion years old. Photo by Matthew Dodd.

Layer-deflecting bright red concretion of haematitic chert (an iron-rich and silica-rich rock), which contains tubular and filamentous microfossils. This so-called 'jasper' is in contact with a dark green volcanic rock in the top right and represents hydrothermal vent precipitates on the sea floor. Nuvvuagittuq Supracrustal Belt, Québec, Canada. Photo by Dominic Papineau.

apatite and carbonate, which are found in biological matter including bones and teeth and are frequently associated with fossils. The researchers also found that the mineralised fossils are associated with spheroidal structures that usually contain fossils in younger rocks, suggesting that the haematite most likely formed when bacteria that oxidised iron for energy were fossilised in the rock.

"We found the filaments and tubes inside centimetre-sized structures called concretions or nodules, as well as other tiny spheroidal structures, called rosettes and granules, all of which we think are the products of putrefaction," said lead author Dr Dominic Papineau. "They are mineralogically identical to those in younger rocks from Norway, the Great Lakes area of North America and Western Australia. "The structures are composed of the minerals expected to form from putrefaction and have been well documented throughout the geological record, from the beginning until today. The fact we unearthed them from one of the oldest known rock formations suggests we've found direct evidence of one of Earth's oldest life forms."

So how were these life forms created in the first place? According to first author Matthew Dodd, "Our discovery supports the idea that life emerged from hot, sea-floor vents shortly after planet Earth formed. This speedy appearance of life on Earth fits with other evidence of recently discovered 3700-million-year-old sedimentary mounds that were shaped by microorganisms."

Not only will the discovery help researchers piece together the history of life on planet Earth, said Dr Papineau — they may also help identify traces of life elsewhere in the universe.

"These discoveries demonstrate life developed on Earth at a time when Mars and Earth had liquid water at their surfaces, posing exciting questions for extraterrestrial life," said Dodd. "Therefore, we expect to find evidence for past life on Mars 4000 million years ago, or if not, Earth may have been a special exception."

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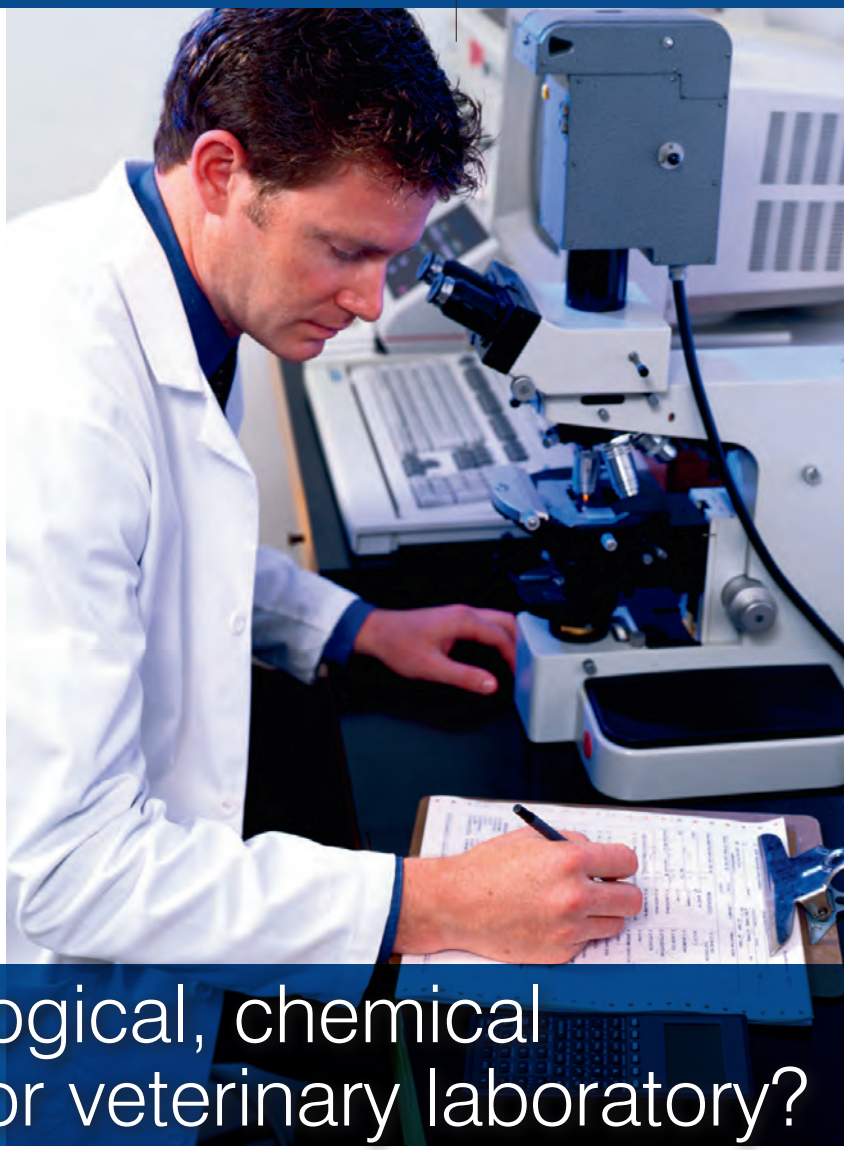
Do you provide any testing, or aspects of testing, on human samples? If so, the Therapeutic Goods Administration (TGA) in vitro diagnostic (IVD) medical device regulatory framework could impact you.



Do you work in a biological, chemical or veterinary laboratory?

What is the IVD framework?

The IVD framework is designed to ensure all IVD medical devices, including in-house IVD medical devices, undergo a level of scrutiny commensurate with the risks associated with their use. In-house IVD medical devices are tests that have been developed or modified within a laboratory (or laboratory network) to carry out testing on human samples, where the results are intended to assist in clinical diagnosis or be used in making decisions concerning clinical management.

All diagnostic tests manufactured by a laboratory, regardless of whether or not they attract a Medicare rebate, are still subject to the requirements of the in-house IVD regulatory framework.

IVD medical devices developed in-house but supplied outside of the laboratory or laboratory network fall outside the definition of 'in-house'. These are considered to be commercially supplied IVDs and must be included in the Australian Register of Therapeutic Goods (ARTG) prior to being supplied outside of the laboratory or laboratory network.

In-house IVD regulatory requirements

The regulations on which the framework is based are not limited to medical testing laboratories, but extend to all laboratories that manufacture in-house IVD medical devices in Australia.

In summary, the TGA IVD framework requires that:

- all in-house IVD medical devices must be notified to or registered with the TGA;
- all Class 1-3 in-house IVD medical devices must be accredited by the National Association of Testing Authorities (NATA) and notified to the TGA;
- Class 4 in-house IVD medical devices must be registered on the ARTG.

Any 'in-house' testing conducted on human samples that assists in clinical diagnosis or used to make decisions concerning patient treatment or management, and which have not been assessed by NATA and notified/registered with the TGA by 1 July 2017, can no longer be legally offered from this date. Further information on the regulatory requirements for in-house IVDs can be found on the TGA website.

NATA accreditation in relation to in-house IVDs

Class 1–3 in-house IVDs will usually be accredited under ISO 15189; however, where a laboratory's main area of testing is not human pathology, accreditation under ISO/IEC 17025 will be considered on a case-by-case basis.

NATA/TGA MoU

In September 2016, NATA and the TGA signed a memorandum of understanding (MoU) which clarifies each party's roles and responsibilities under the regulatory framework, with a particular focus on the cooperation and exchange of information and material on matters relating to the accreditation of laboratories engaged in the manufacture of in-house IVD medical devices.

If you are unsure whether the testing your laboratory is performing falls under the TGA in-house IVD medical device regulatory framework, please see the TGA website or email devicereforms@tga.gov.au.

NATA
www.nata.asn.au

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Science at the Shine Dome
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www.science.org.au/news-and-events/events/science-shine-dome

FUTORES II
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www.jcu.edu.au/futores

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VIZBI 2017
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Australian Marine Science Conference 2017
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SPARCS VII The Precursors Awaken
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Carbon 2017
July 23–28, Melbourne
www.racicongress.com/Carbon2017/

RACI National Centenary Conference 2017
July 23–28, Melbourne
www.racicongress.com/RACIConference/

ICPEAC XXX
July 26–August 1, Cairns
http://icpeac30.edu.au/

The Asia Hub for e-Drug Discovery (AHeDD) Symposium 2017
July 27–28, Melbourne
www.racicongress.com/AHeDD2017/

The Lancet Summit: COPD and Lung Cancer
July 28–29, Perth
www.thelancetsummit.com/

Analytical and Bioanalytical Techniques Congress
August 2–4, Melbourne
www.meetingsint.com/pharma-conferences/analytical-bioanalytical

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Translational control, the Achilles' heel of cancer

Peter MacCallum Cancer Centre, 11 May, 2017

Organizers:

- Luc Furic (Monash University, Australia)
- Rick Pearson (University of Melbourne, Australia)

Speakers:

- Ross Hannan (The Australian National University, Australia)
- Ola Larsson (Karolinska Institutet, Sweden)
- Lisa Lindqvist (Walter and Eliza Hall Institute, Australia)
- Lynne-Marie Postovit (University of Alberta, Canada)
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