Lab+Life SCIENTIST

Working hard for the mummy

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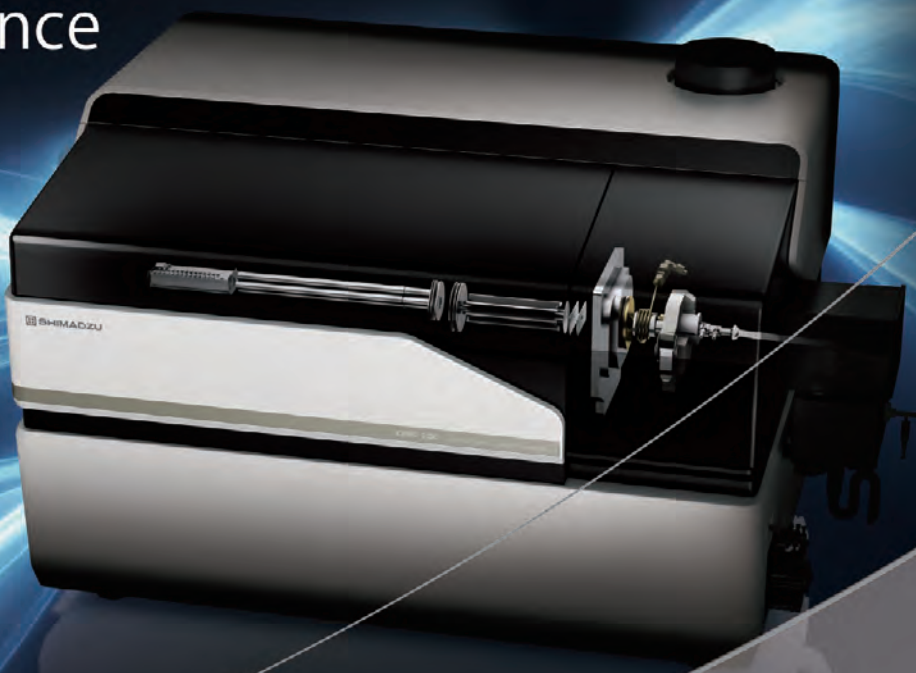

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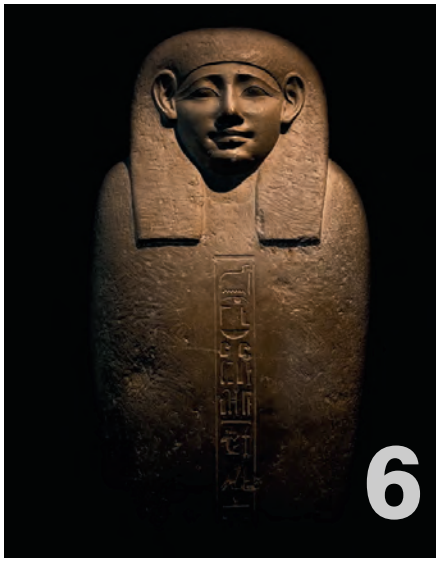

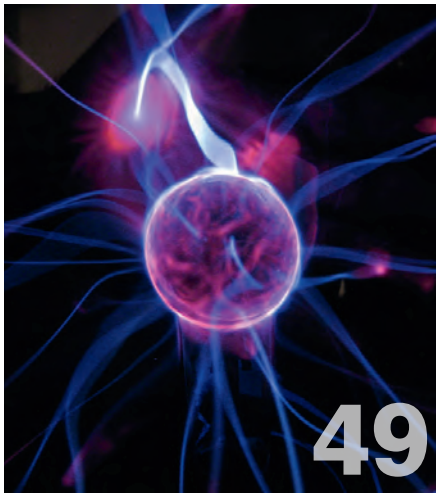

Adam Florance

Art meets science

The evolutionary dimensions of creative expression

A Tasmanian art gallery may seem an unlikely venue for a scientific meeting covering fields as diverse as theoretical neurobiology, cognitive psychology, psycholinguistics, visual cognition, evolutionary psychology, epistemology, ethics and metaphysics, but Hobart's most unconventional art gallery has, in its short life, earned an international reputation for smashing established conventions.

Recently pipping its London and New York rivals to be listed as one of Lonely Planet's 500 Best Places in the World, and entirely self-funded from gambling profits, David Walsh's Museum of Old and New Art (Mona) has invited four eminent 'biocultural scientist-philosophers' to concurrently curate four exhibitions that examine the evolutionary and biological origins of art.

'On the Origin of Art' is scheduled to open in November and will aim to explain the science behind creative expression, as seen through the eyes of evolutionary psychologist Geoffrey Miller, evolutionary neurobiologist Mark Changizi, professor of literature and evolution Brian Boyd and cognitive scientist Steven Pinker.

Not averse to throwing his gambling wealth around, Walsh has given the four scientists carte blanche to stage new commissions, borrow works from public or private collections around the world and raid Mona's own extensive collection. During a recent interview with the ABC's Jennifer Byrne at the Athenaeum Theatre in Melbourne, Walsh announced that plans for On the Origin of Art are proceeding admirably: "We're far enough down the track that I can tell you it's gonna be a bloody good exhibition ... possibly three bloody good exhibitions and one dud."

Calling himself a 'Catholic atheist', Walsh believes that the fundamental guiding forces of Darwinian evolution are sex and death — themes he has been obsessed with since a child and the driving force behind investing $180 million of his own money to build Mona.

This is not the first time that Mona has straddled the art-science fence.

Many visitors to the museum have been entranced, and appalled, by the odours produced from Belgian artist Wim Delvoye's Cloaca Professional — a bacteria machine that simulates digestion, which has been affectionately nicknamed the 'poop machine'. In 2014, curator Kirsha Kaechele launched a scientific art experiment aimed at improving the health of Hobart's heavily polluted Derwent River. The Derwent Estuary Program utilised the natural heavy-metal absorbing qualities of oysters to extract and sequester river pollutants from industrial run-off in a concrete and glass oyster mausoleum. Designed by staff and students from Monash Art Design and Architecture, it is known as the Heavy Metal Retaining Wall. Dr Catriona Macleod of the University of Tasmania's Institute for Marine and Antarctic Studies said the Derwent Estuary Program has helped reduce the levels of mercury, lead, cadmium, zinc and copper in the river.

On the Origin of Art is scheduled to run from November 2016 until April 2017 at the Museum of Old and New Art in Hobart, Tasmania.

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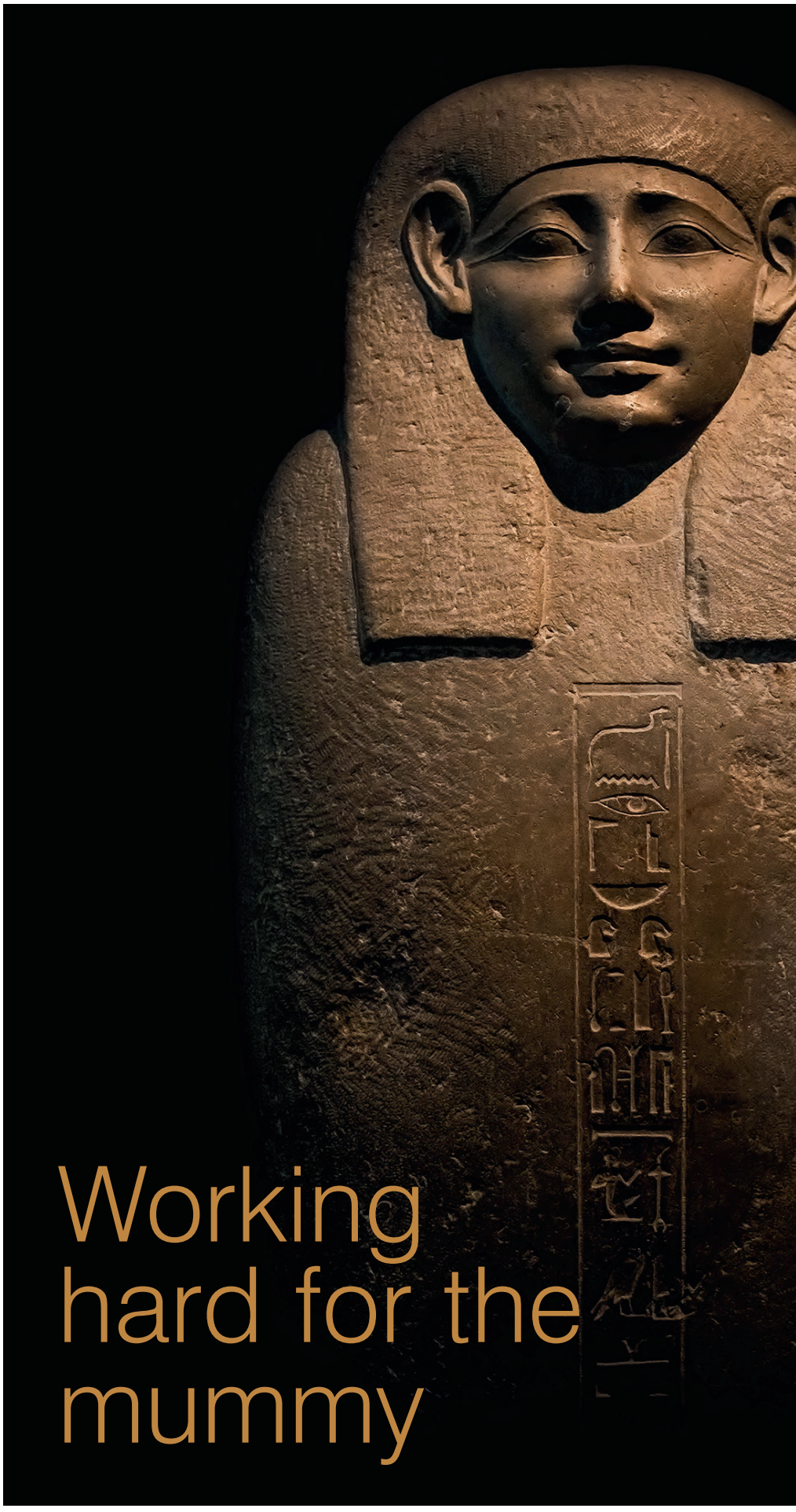
Lauren Davis

Working hard for the mummy

Sydney University Museums (SUM) is the proud owner of several ancient Egyptian artefacts, including monumental sculptures, inscriptions, organic materials and, of course, mummies. As part of its efforts to preserve these >2000-year-old pieces of history, SUM engaged the expertise of gas company BOC to help update its anoxic (absence of oxygen) treatment program.



Anoxic treatment was originally developed in the 1960s and is used by many museums globally to ensure artefacts' survival, primarily by preventing insect attack. Contemporary anoxic treatment sees artefacts placed in oxygen-tight bags which are flushed with nitrogen and sealed with oxygen scavengers — similar to the ones you remove from sealed long-life food packaging — which are designed to remove any oxygen that remains in the bag. Once suitably stored, the objects are protected from deterioration resulting from fluctuating or excessively high or low humidity levels and damage from exposure to light.

Yet despite anoxic treatment being a mainstay of the museum world for a long time now, SUM Conservator Alayne Alvis had to push for its usage at the museums since her appointment eight years ago.

"We just didn't have the gear and the space to do it," Alvis said. "And this is a treatment that we really ought to be able to do. For something like a mummy, you can only do an anoxic treatment. Other treatments might involve freezing — you can't do that to a mummy.

"You can do very small-scale treatments just by using oxygen scavengers in your bag, but you're very limited, because if you start using more than a couple per treatment, it starts getting very expensive."

Other museums have solved this problem by building their own systems, but Alvis was the first to admit that she has "no skill in that area". As such, she took advantage of the University of Sydney's contract with BOC, supplying the company with

Contemporary anoxic treatment sees artefacts placed in oxygen-tight bags which are flushed with nitrogen and sealed with oxygen scavengers

literature and concept sketches of the nitrogen purging process in the hope that it would come up with a suitable system.

"I wanted to make sure that we had a system that was compliant with any safety requirements the university had, and that would actually do the task that I needed it to," said Alvis.

Site visits allowed the BOC team, led by John Roynon, to familiarise themselves with the task, how museum staff intended to use the equipment and the special needs of the artefacts. Although Roynon had not worked in a museum environment before, he noted that "the whole process of removing oxygen from an environment to preserve products is very common".

"We took an old concept and brought it up to date, made it comply with current legislation and considered all the safety assets which had never really been considered before," Roynon said. "And also, designing it for ease of use so the people doing it could repeat it time and time again without much difficulty and get the same result."

One particular consideration was that the first major treatment using the nitrogen purge system would be treating two of the mummies held by SUM's Nicholson Museum — artefacts which, as Alvis pointed out, were once human brings.

"We discussed any cultural issues when working with human remains at length with the BOC engineer on-site," said Alvis. "We are very mindful that we are dealing with human beings and try to treat them with respect."

BOC understood the importance of keeping the artefacts in a constant environment, protected from any drastic fluctuation in humidity, light and gas levels. The company also had to consider the issue of preserving these ancient objects with pure, dry nitrogen.

"The dryness of the gas creates a problem for them, because these old artefacts are very brittle and need quite a high humidity level to keep them supple and stop them from just breaking and crumbling away," noted Roynon. "So we wanted the nitrogen atmosphere and we wanted the low oxygen content, but we actually needed a relatively high humidity."

With this in mind, BOC developed a tailored process to deliver nitrogen at the correct relative humidity of around 50%. The process involves placing the artefact in a nearly completely sealed bag with two small openings for nitrogen injection and venting.

Once the nitrogen supply has been tested, the gaseous nitrogen is passed through a series of chambers before being used to purge the atmosphere from the bag. The first chamber is used to pass the nitrogen through water to humidify it; this is then mixed with dry nitrogen in the second chamber.

The resultant mixture is then analysed for correct relative humidity in a third chamber with a hygrometer before being applied to the bag containing the artefact. When the humidified nitrogen passes into the bag at opening, it causes the atmosphere to flow out of the bag from the other opening.

The use of humidified nitrogen has enabled SUM to protect a wider range of artefacts from deterioration, including large and vulnerable objects like mummies. Alvis said, "It's added a string to our bow; it's been able to make us do things that we weren't able to do in the past."

Equally important was the prevalence of safety features in the system design, with Roynon saying some people don't realise that nitrogen is an asphixiant — and all it takes is a small depletion in oxygen levels before its effects can take hold.

"So bringing nitrogen into a closed and fairly small environment presents some risks in that respect, and it's about understanding those risks and making sure there's adequate ventilation and that you can't release so much nitrogen into the air that you're presented with a low-oxygen situation," he said.

"You've got a cylinder of nitrogen which has a high pressure of 200 bar and you've got to make sure that anything you're applying gas into can withstand whatever pressures you put into them."

As such, BOC's equipment includes in-built safety features such as single-direction flow valves and a pressure release valve, ensuring the system doesn't fail even if the operator does something wrong. Alvis, who

has trained herself up in the use of gases, explained, "If the pressure in the system gets too high, the gas will bleed off and it will make a noise, so you know it's time to turn the pressure down."

The equipment is now permanently based at SUM, where Alvis expects it to remain for the next 10–20 years — saving the museums time and money in the process.

"I can just walk in, do a treatment straight away; it'll take me half an hour, and with a helper I can maybe pack 15 to 20 items in the course of a day," she said.

"The cost of your consumables is much lower, because a tank of nitrogen will set you back $9 for a couple of cubic metres. So it's a budgetary thing as well. I can do more with the same amount of money."

As for Roynon, he'll be adding his work with SUM to the long list of projects he's completed during his time with BOC.

"I've worked with Formula 1 teams in the UK, where they were building and developing cars, and they use gases in a lot of their manufacturing processes. I've worked in the aircraft industry, with Rolls Royce — they actually use high-pressure argon to inflate metal balloons to make the shape of turbine blades. I've worked extensively with McDonald's in the UK on all of their freezer systems. We worked with a coffee company who used liquid nitrogen to recover the volatile compounds that came off of the coffee roasting process. I've worked on freezing sperm for animal husbandry. I've worked with a lot of hospitals on storage of biological samples. I've worked in nuclear reprocessing.

"The gas industry pretty much touches every other industry," Roynon said. "You don't know what's going to come round the corner."

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Counting molecules with a mobile phone

Scientists from the California Institute of Technology have invented a technique that will help bring emerging diagnostic capabilities out of laboratories and to the point of care. Writing in the journal *ACS Nano*, the researchers document their efforts to make diagnostic health care a reality in areas with limited resources, where the procedures required to detect molecular markers are too complex or expensive to be used outside of a central laboratory.

To address the need for a robust readout system for quantitative diagnostics, researchers from the lab of Professor Rustem Ismagilov lab invented a visual readout method that uses analytical chemistries and image processing to provide unambiguous quantification of single nucleic-acid molecules that can be performed by any camera phone. The readout method is validated using RNA from the hepatitis C virus, HCV RNA.

The work utilises a microfluidic technology called SlipChip, which was invented in the Ismagilov lab several years ago. A SlipChip serves as a portable lab-on-a-chip and can be used to quantify concentrations of single molecules. Each SlipChip encodes a complex program for isolating single molecules (such as DNA or RNA) along with chemical reactants in nanolitre-sized wells.

The chip consists of two plates that move or 'slip' relative to one another, with each slip joining or separating the hundreds or even thousands of tiny wells, either bringing reactants and molecules into contact or isolating them. The architecture of the chip enables the user to have complete control over these chemical reactions and can prevent contamination, making it suitable for a user-friendly, robust diagnostic device.

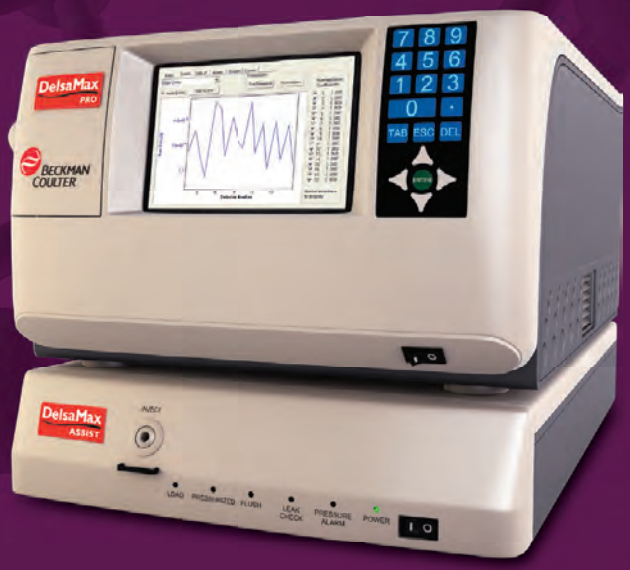
The new visual readout method integrates special indicator chemistries into the wells of the SlipChip device. After an amplification reaction, the well changes colour depending on whether the reaction in it was positive or negative. If a SlipChip is being used to count HCV RNA molecules in a sample, a well containing an RNA molecule that amplified during the reaction would turn blue, whereas a well lacking an RNA molecule would remain purple.

To read the result, a user simply takes a picture of the entire SlipChip using any camera phone. Previous SlipChip technologies utilised a chemical that would fluoresce when a reaction took place within a well, providing readouts which were unfortunately either too subtle for phone camera detection or required specific lighting conditions. However, the new method processes the photo using a ratiometric approach that transforms the colours detected by the camera's sensor into an unambiguous readout of positives and negatives.

"The readout process we developed can be used with any cell phone camera," said Jesus Rodriguez-Manzano, one of two first authors on the paper. "It is rapid, automated and doesn't require counting or visual interpretation, so the results can be read by anyone — even users who are colour blind or working under poor lighting conditions.

"This robustness makes our visual readout method appropriate for integration with devices used in any setting, including at the point of care in limited-resource settings. This is critical because the need for highly sensitive diagnostics is greatest in such regions."

IT TAKES LONGER TO READ THIS HEADLINE THAN IT DOES TO ANALYZE A 1 µL SAMPLE.



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Life Sciences

Dry and resoak: the new way to speed up bioassays

Scientists from the University of Washington (UW) have proposed a way to speed up the time it takes to conduct biological assays. Their solution, reminiscent of the science behind washing machines, could reduce wait times from hours to minutes.

Many biological assays use molecules such as antibodies to detect specific types of cellular proteins or pieces of DNA. These 'detector molecules' only bind to specific targets, such as a certain class of cellular proteins, and include additional components such as nanoparticles or dye molecules to emit light if they successfully bind. These assays have revealed where different proteins are found in cells and helped diagnose diseases — but such tests can take hours or days to complete.

The detector molecules, suspended in a fluid, float around while their targets — whether cellular proteins or pieces of DNA — are adhered to the hard, flat surface of a small plate or Petri dish. While bulky detector molecules close to the surface can easily find and bind to their targets, molecules further up in the fluid column move slowly due to their size. It can take hours for enough detector molecules to diffuse down and bind to their targets to produce a visible colour change. This is called diffusion limitation.

UW Associate Professor Xiaohu Gao and his team decided to tackle the problem of diffusion limitation after they developed a new staining assay whose long reaction times made their protocol impractical. Instead of waiting for detector molecules to drift down to the surface of the plate, they allowed detector molecules close to the surface to bind. They then drained the solution from the plate, mixed it, put it back on the plate and repeated this cycle dozens of times — what they call cyclic solution draining and replenishing.

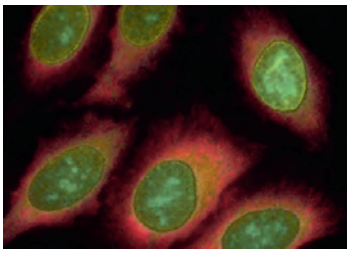
"In a washing machine, you squeeze water out and put it back in," said Associate Professor Gao. "Dry and resoak. Dry and resoak. This is exactly the same mechanism: drain the fluid completely and then put it back on the plate. That's much more efficient than simply stirring it around."

To drain fluid from the plate, the team covered the plate with a seal and inverted it. To resoak, they flipped the plate upright again. The flipping action helped mix the detector molecules in the fluid, which sped up the total reaction time. And while sealing and flipping might be impractical for some tests, Associate Professor Gao noted that "you could use air bubbles or centrifugation to drain as well".

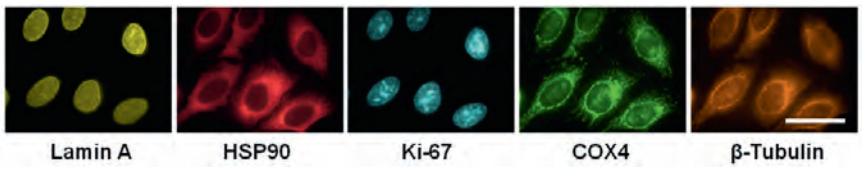
The team tested cyclic solution draining and replenishing with two antibody staining techniques: ELISA and immunofluorescence microscopy. Reaction times for both were cut substantially; in one case, a one-hour incubation time was cut to just seven minutes. The results of the study have since been published in the journal *Small*.

"When we prepare tea, we don't let it sit there or shake the cup," said Associate Professor Gao. "We repeatedly lift, drain the tea bag, then lower it into the hot water. That's what we've done here.

"This was a common problem that no-one before had made a link to. But here we have, and it's so simple."



A composite image of HeLa cells stained sequentially with antibodies to five different proteins. Image credit: Xiaohu Gao.



These HeLa cells were sequentially stained using antibodies bound to five different cellular proteins. Each staining procedure took 10 min with the cyclic solution draining and replenishing method, whereas other methods would need 60 min to produce the same level of staining. Image credit: Xiaohu Gao.

Partnership to fight prostate cancer

Two key players in the fight against prostate cancer — ANZUP Cancer Trials Group (ANZUP) and the Prostate Cancer Foundation of Australia (PCFA) — have announced that they will work together to fund and implement vital clinical trials into the disease.

ANZUP is said to be the leading collaborative trials group for urogenital and prostate cancer in Australia and New Zealand, while the PCFA is the peak national body for prostate cancer. The two bodies have worked closely for many years, according to ANZUP CEO Margaret McJannett, who said a formal partnership is "the logical next step for clinical trials in prostate cancer".

The groups have agreed to improve access to clinical trials and have pledged to work together to raise $1.5 million over the next three years to fund trials. As noted by McJannett, "Clinical trials are the gold standard for developing new cancer treatments and showing which treatments are the safest and most effective.

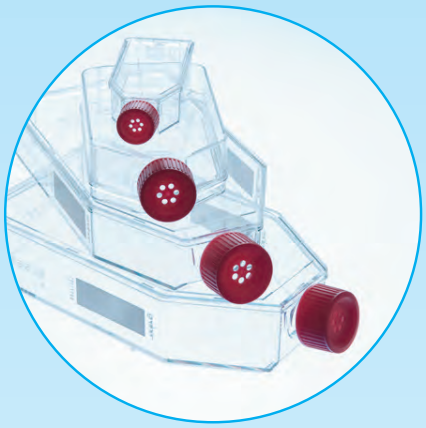
"Trials independent of drug companies are particularly valuable, as they focus only on patient benefit with no commercial stake," she continued.

"For Australia's peak prostate cancer charity to team up with the leading independent provider of clinical trials in Australia and New Zealand opens up a range of opportunities in clinical research."

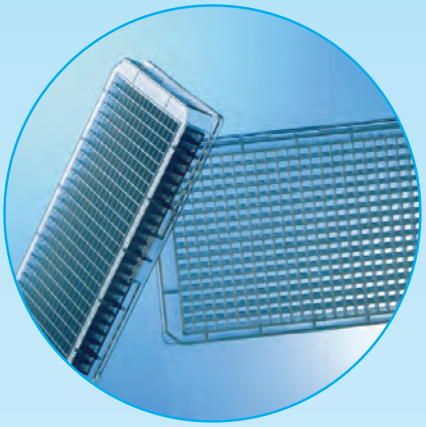
The Power of Science

Cryo Storage

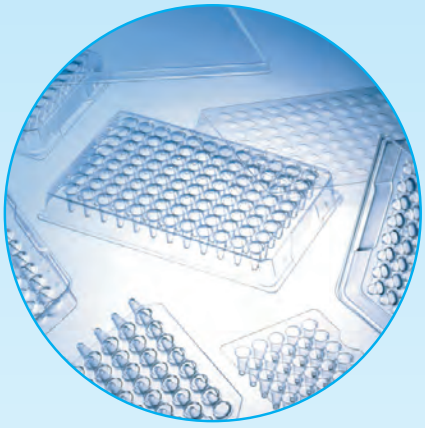
Cell Culture



High Throughput Solutions

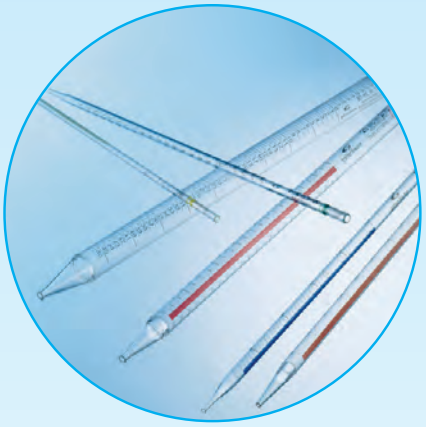


Molecular Biology

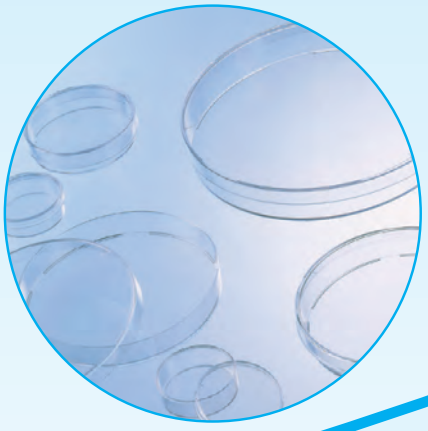


Centrifugation

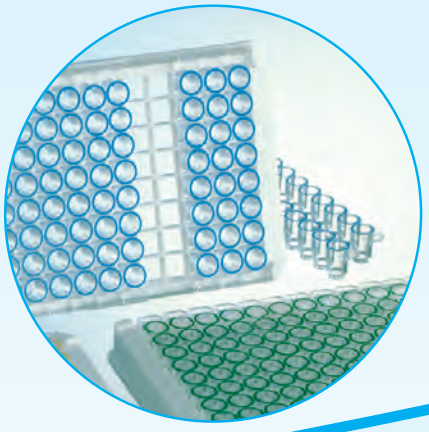
Liquid Handling



Microbiology



Immunology



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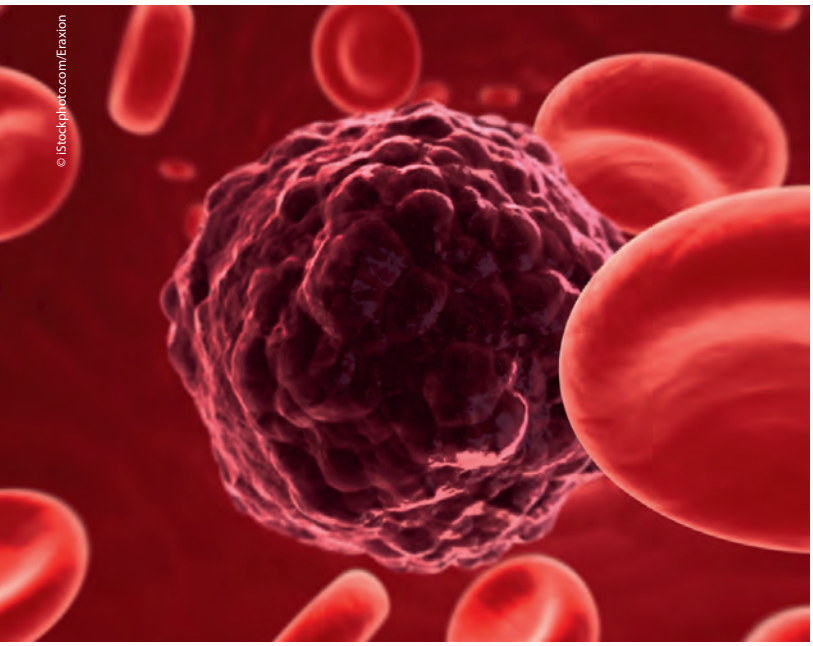


The protein that keeps cancer cells alive

Researchers from the Walter and Eliza Hall Institute have discovered a protein that is key to the development of blood cancers caused by a common genetic error.

Around 70% of human cancers have abnormally high levels of the protein MYC, which forces cells into unusually rapid growth. Writing in the journal *Cell Reports*, the scientists revealed that blood cancers driven by MYC could be prevented by lowering the levels of another protein, called MCL-1.

Study co-author Dr Stephanie Grabow said developing cancer cells are dependent on MCL-1, a protein that keeps stressed cells alive by preventing programmed cell death (apoptosis). "No-one had realised just how vulnerable cells undergoing cancerous changes are to a relatively minor reduction in the levels of MCL-1," she said. "We found that MCL-1 is critical for keeping developing cancer cells alive through the stressful events that cause the transformation of a healthy cell into a cancerous cell.

"This result is particularly exciting because MCL-1 inhibitors are already in development as anticancer drugs. Our colleagues had previously discovered that reducing the activity of MCL-1 is a promising strategy to treat malignant MYC-driven cancers. We have now shown that the same approach might be able to prevent those cancers from forming in the first place."

Co-author Dr Brandon Aubrey added that the research could inform future strategies to prevent cancer, stating, "Cancer researchers are building a better picture of who is at risk of developing cancer and enhancing how we can detect early-stage cancer in people before it has grown to the point of causing illness.

"Our research has suggested that dependency on MCL-1 could be a key vulnerability of many developing cancers," he said. "In the future, MCL-1 inhibitors might have potential benefit for treating the very early stages of MYC-driven cancers, or we may even be able to use these agents to prevent people from getting cancer in the first place."

Imaging technology centre opens in Queensland

Queensland Premier Annastacia Palaszczuk, joined by Minister for Innovation, Science and the Digital Economy Leeanne Enoch, has opened the TRI Innovation and Translation Centre in collaboration with Siemens Healthcare. Based at Princess Alexandra Hospital, it is said to be the second facility of its kind in the world.

A collaboration between Queensland's Translational Research Institute (TRI) and medical devices manufacturer Siemens Healthcare, the centre will give the TRI the capability to develop the imaging technology and protocols needed to evaluate new targeted therapies as well as new cancer vaccines being developed by TRI founder and University of Queensland (UQ) scientist Professor Ian Frazer. It will draw on a multidisciplinary mix of researchers and professionals from biomedical science, medical imaging, biomedical engineering, imaging analysis, big data and modelling.

Palaszczuk said a key focus of the centre is on strengthening the working relationship between business and research. She noted, "Government and medical research institutes can't commercialise a medical innovation and make it available worldwide — only organisations like Siemens Healthcare can achieve that.

"By partnering with business, we can get critical research out of the lab and into the marketplace, and that means future jobs for Queenslanders."

The centre will be supported by the Queensland University of Technology (QUT), which has significant experience in establishing world-class research infrastructure and laboratories. QUT Deputy Vice Chancellor Professor Arun Sharma said the university is "funding three radiographers for three years for this program, and these staff will supply a high level of expertise and support to our consortium partners".

The Queensland Government will provide $3.25 million to the centre over three years as part of the Advance Queensland Future Jobs Strategy. Other collaborators on the centre include UQ, Queensland Health and Mater Research, with the centre looking to partner with QIMR Berghofer and the Hunter Medical Research Institute in Newcastle.

Second US patent for Australian immunoassay technology

Adelaide biotechnology company TGR BioSciences has received its second US patent in six months, covering key aspects of the company's Capt*Sure* immunoassay technology. The technology is said to accelerate and simplify immunoassay procedures, making it applicable to many areas of biology, including life sciences, clinical diagnostics and plant disease detection.

US Patent 9,086,407, granted to TGR on 21 July 2015, gave the company exclusive rights to license Capt*Sure* to researchers and manufacturers around the world. US Patent 9,261,500, granted on 16 February, covers additional aspects of Capt*Sure* products including ELISA and bead-based offerings.

"This patent allows us to expand our technology to include other assay formats, including microfluidics products," explained TGR Chief Scientific Officer Dr Antony Sheehan.

"We can now broaden our partnerships with other bio-manufacturing companies and laboratories to expand the use of this technology."

In comparison to conventional assays, which usually involve three separate incubations over 2–3 days or more, Capt*Sure* only requires a single incubation and wash step. This is made possible by incubating the sample with both 'capture' and 'detector' antibodies at the same time.

Dr Sheehan said TGR's innovative technology enables not only faster, easier and more versatile assays, but also reduces manufacturing costs by simplifying test development as well as reducing the amount of core reagents required.

"These advantages translate to a very high-value technology for TGR and increased benefits for the industry," he said.

"The benefits of faster, easier and lower cost assays can be delivered to a variety of market segments, including clinical diagnostics, drug development and agriculture."

Australian-developed bowel cancer test approved in China

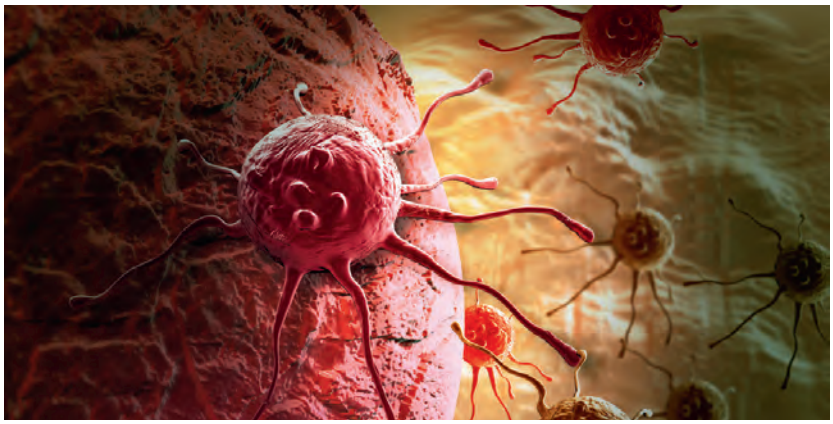
Biotech company Clinical Genomics has received China Food and Drug Administration (CFDA) approval for the commercialisation of InSure FIT, its faecal immunochemical test for colorectal cancer.

Warren Bingham, Clinical Genomics VP, Asia Pacific, said the CFDA approval represents another international vote of confidence in the company's cancer testing solutions. It comes 16 months after Clinical Genomics appointed clinical diagnostics company BioChain Group as its exclusive Chinese distribution partner, and 17 years after the first person was screened using InSure FIT.

"Screening with faecal immunochemical tests is a guideline-endorsed option being adopted worldwide based on clear evidence that it will save lives," said Bingham. "Governments are actively seeking affordable, effective and user-friendly cancer screening solutions for their communities.

"The InSure FIT 'brush' is easy to use and is designed for large screening programs. This test is ideal for large countries such as China with regional and remote communities that may not otherwise have accessible screening options."

Clinical Genomics' goal is to position the InSure FIT as being suitable for integration into the China Cancer Screening Program recently announced by the Chinese Government.



Building the next generation of STEM

Queensland-based industry body Women in Technology (WiT) is launching STEMed — a one-day festival of education for the future.

Open to all ages, the event will be jam-packed with inspiration, interactive sessions, childminding, age-appropriate tech activities and a trade exhibition showcasing the latest in science, technology, engineering and maths (STEM). The aim of the festival is to prepare our youth for the 75% of jobs in the future that will require STEM skills.

"STEMed is about equipping educators, parents and our kids with the skills, confidence and knowledge to embrace where STEM will take us in the future," said WiT President Fiona Hayes.

"Robots, entrepreneurship, coding, social media, gaming, app development and 3D printing are set to be hot topics over the action-packed one-day event."

The event will also feature keynote speaker David Bartlett — former Premier of Tasmania, Minister for Education and Skills and Minister for Innovation, Science and Technology — who will speak about building the next generation. Bartlett serves as the adviser, co-founder and non-executive director of a number of tech start-ups and advises industry sectors and governments on how to plan for digital disruption.

The event will be held on 29 May at the Royal International Convention Centre. For more information and to book tickets, visit http://www.stemedfest.com.

AppNotes

Rapid data centre expansion

When the Finland-based CSC – IT Centre for Science needed to expand its data centre infrastructure, it turned to CommScope and its Data Center on Demand (DCoD) family of prefabricated modular data centres.

Managed under the auspices of Finland's Ministry of Education and Culture, CSC is a major research resource for the country. It has developed and maintained a comprehensive IT infrastructure, providing IT services and research management for libraries, museums and other cultural entities across Finland.

While researching options for a new data facility, a traditional brick-and-mortar data centre was explained by Tero Tuononen, director of ICT platforms for CSC, "Our existing brick-and-mortar template would not work.

"We needed a more cost-efficient approach with a properly prepared site that could accommodate multiple data centres, with the ability to scale on demand as our needs changed."

CSC chose CommScope's DCoD solution with its prefabricated modular design. Tuononen said the modular data centre strategy was "a logical choice", as it "eliminated the planning risks associated with the traditional monolithic build projects while allowing us to take advantage of future improvements in server and switch technologies".

Deployment of DCoD is quick and easy — capacity can be added in 14 to 20 weeks, rather than the two to three years it takes to build a typical brick-and-mortar facility. DCoD merely requires access to power, water and ventilation.

CSC was also drawn to CommScope's SmartAir Intelligent Cooling System, a flexible and efficient cooling solution that minimises energy consumption. The technology accomplishes this by monitoring over 200 parameters within the DCoD and then determining the most effective way to meet the prescribed operating parameters using outside air and adiabatic (evaporative) cooling.

CommScope's super efficiency has trimmed cooling costs to less than 5% of IT energy costs — a huge saving from other options, where the number can exceed 60%.

Finally, as DCoD is purpose built to CSC's specific needs — and arrives pretested — much of the risks associated with the implementation are removed.

With a traditional brick-and-mortar approach, you need to account for the complexities associated with construction and bespoke design costs, such as architects and mechanical and electrical design services. But with DCoD, you basically buy a system that integrates with an existing infrastructure.

CSC deployed its first CommScope DCoD modular data centre in 2012, adding a second at the end of 2014. In fewer than three years, DCoD has delivered significant bottom-line benefits to the organisation, including:

Power usage effectiveness (PUE) reduction: While the average PUE for a typical data centre varies from 1.8 to 2.9, the DCoD installation at CSC averages 1.03 to 1.06.

Water savings: One DCoD unit consumed roughly 120 m^3 of fresh water in a year — less than the amount used by a typical family house.

Sustainability: Reduced energy consumption and costs demonstrate CSC's commitment to leading-edge technologies that reduce its carbon footprint and complement its ecological credentials.

"Our design objectives were met and exceeded by CommScope," concluded Tuononen.

"As CSC's compute and data demands continue to rise, we expect DCoD to deliver even better results in the future."

Commscope

commscope.com

Particle characterisation instruments

The DelsaMax Series offers speed and precision, enabling users to advance their nanoparticle research. Each instrument is said to help users get insight out of even the smallest samples, faster than ever.

The DelsaMax PRO light-scattering analyser is a laser-based instrument that achieves reproducible measurements of traditionally challenging protein samples, including antibody formulations, bovine serum albumin and lysozyme.

The QELS function provides simultaneous measurement of the macromolecular hydrodynamic radius utilising backward-scattered light to determine the sample translational diffusion coefficient.

Beckman Coulter Australia
www.beckmancoulter.com

Aggresome visualisation kit

Aggresomes are inclusion bodies that form when the ubiquitin-proteasome machinery is overwhelmed with aggregation-prone proteins. Certain inclusion bodies associated with human disease are thought to arise from an aggresomal response, including Alzheimer's disease as it relates to intracellular and extracellular aggregates, Lewy bodies associated with neurons in Parkinson's disease and more.

Enzo's PROTEOSTAT Aggresome Kit, a cell-based assay to detect aggresome formation, can be used to achieve physiologically relevant results. The product provides a sensitive cell-based assay of drug responsiveness to identify inhibitors relevant to neurodegenerative disease in an authentic cellular context. It easily quantifies aggresome and related inclusion bodies by flow cytometry.

The simple assay does not require non-physiological protein mutations or genetically engineered cell lines. It has been validated under a wide range of conditions and with small molecule modulators, demonstrating suitability for screening compounds of potential therapeutic value. The kit is useful for the study of neurodegenerative diseases, liver disease, toxicology studies and more.

United Bioresearch Products Pty Ltd
www.unitedbioresearch.com.au

Inductively coupled plasma mass spectrometer

The Shimadzu ICPMS-2030 Inductively Coupled Plasma Mass Spectrometer is designed to respond to the ICH Q3D guidelines for elemental impurities in pharmaceutical products.

The ICH Q3D specifies allowable limits of daily intake of 24 elements of toxicological concern and requires high-sensitivity and high-precision measurement of such elements. The product satisfies these requirements with ppt-level high sensitivity, which is achieved by collision cell and optimised internal structure offering FDA 21 CFR Part 11 compliance, automated analytical method development function and a measurement result evaluation function.

The optimised internal structure, including the collision cell, enables analysis at sub-ppt level sensitivity by minimised spectral interference and improved transmission efficiency of atomic ions. Through the product's Assistant functions and LabSolutions Software Development Assistant function, users can simply perform qualitative analysis by selecting the elements to be measured. The software then automatically sets the suitable analysis conditions.

The product is said to reduce argon gas consumption and lower running cost via its mini-torch and Eco Mode, using 99.95% purity argon instead of conventional 99.999% purity argon.

Shimadzu Scientific Instruments (Oceania) Pty Ltd
www.shimadzu.com.au

Scientific CMOS 4.2 MP camera

The PCO.edge sCMOS 4.2 LT camera offers 4.2 MP and is equipped with a scientific CMOS sensor providing crisp images and precise measurements. It is designed for users who require high quantum efficiency, 16-bit dynamic range, long exposure times and low readout noise.

The product has a combination of high resolution (2048 x 2048 pixels), high quantum efficiency (>70%), high frame rates (40 fps max) and high dynamic range (37,500:1). Other features include a rolling shutter time of 100 μs to 10 s, a global reset time of 30 μs to 2 s and low readout noise of 0.8 e- med. The ultracompact camera has a lightweight body and USB 3.0 interface.

Areas of application include spinning disk confocal microscopy, live cell microscopy, GSDIM, PALM, STORM, SPIM, SIM, single molecule detection, lightsheet microscopy, FRET, FRAP, adaptive optics, high content screening, ophthalmology and flow cytometry.

SciTech Pty Ltd
www.scitech.com.au

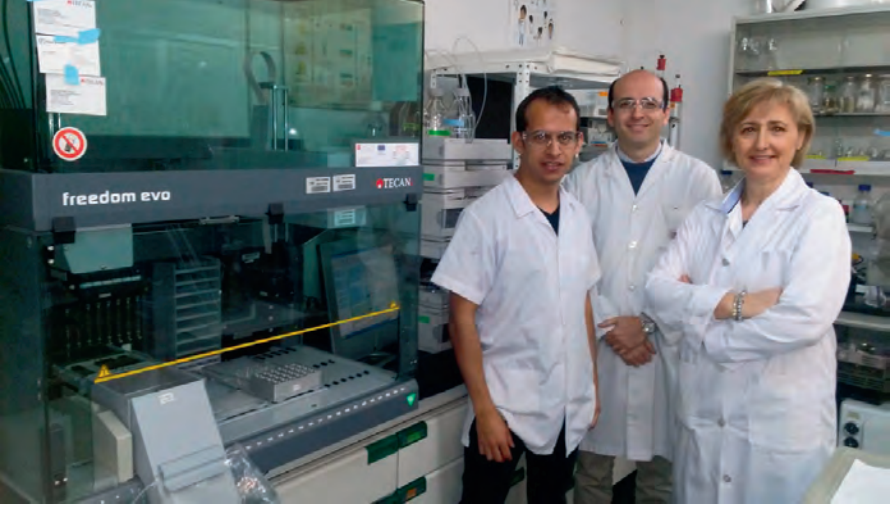
Simultaneous analysis of gene and protein expression

The nCounter RNA:Protein PanCancer Immune Profiling Panel enables simultaneous analysis of gene and protein expression. Integrating RNA and protein measurements simplifies research, enabling users to see how proteins are associated with gene signatures in a single experiment and eliminating the challenge of comparing data from different technologies with different outputs.

Robust and reproducible, the technology enables a way of looking at immuno-oncology systems through analysis of RNA and protein from as few as 150,000 cells (up to 500,000 cells for PBMCs and primary cells), enabling users to get results on more of their samples. Based on the nCounter digital molecular barcoding technology, this approach removes potential bias that can occur in systems that require amplification. The product's protein detection demonstrates high correlation (R2>0.75) with gold-standard flow cytometry.

NanoString's protocols enable users to run both PBMCs and cell suspensions of solid tumours, without compromising reproducibility. The design can be customised through the addition of up to three proteins with NanoString's Protein Barcoding Service. No bioinformatician is required, with simple data output delivered in a CSV file.

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



Liquid handling workstation

The Freedom EVO 75 is a small-footprint robotic workstation with plenty of flexibility.

The open liquid handling platform has been developed to perform repetitive liquid transfer tasks, either as a standalone instrument or linked through automation to an analytical system, allowing users to automate methods using their preferred chemistry. The product is available as either a fully modular, open platform or preconfigured for a number of ready-to-run applications.

The platform can be used for automated applications such as nucleic acid extraction; ELISA processing; PCR and sequencing reaction set-up; serial dilutions; MALDI spotting; immunostaining protocols and in situ hybridisation (ISH); and capillary electrophoresis set-up.

Tecan Australia
www.tecan.com.au

Electronic pipette

The INTEGRA VIAFLO 96 is a handheld 96-channel electronic pipette that enables fast, precise and easy simultaneous transfer of 96 samples from microplates.

The product requires no special skills or training to operate it. Fast replication or reformatting of 96-well plates, plus high-precision transferring of reagents, compounds and solutions to or from microplates, becomes as easy as pipetting with a standard electronic pipette into a single tube.

Four pipetting heads with pipetting volumes up to 12.5, 125, 300 or 1250 µL are available. The pipetting heads are interchangeable within seconds, enabling optimal matching of the available volume range to the application performed.

BioTools Pty Ltd
www.biotools.com.au

Cleaning procedures

to protect Parkinson's researchers

Scientists have revealed the cleaning procedures that best protect Parkinson's disease (PD) researchers from alpha-synuclein (α-Syn), a protein that makes up Lewy bodies and Lewy neurites in PD patients and self-assembles into fibrils in vitro. If introduced into the human body, these seeds can act as prions and trigger the formation of toxic protein deposits.

α-Syn is purified and assembled in test tubes into fibrils that are used to investigate/mimic PD pathogenesis in model animals, ranging from worms to rodents and non-human primates in a large number of laboratories. These laboratories typically contain surfaces and non-disposable items made from plastic, glass, aluminium or stainless steel. These items are often rough, with areas that cannot be completely cleaned by wiping. Therefore, it is important to minimise contamination through effective cleaning procedures.

"Several teams, including ours, demonstrated that fibrillar α-Syn propagate from one cell, including neurons, to another and amplify during this propagation process mimicking prion particle behaviour," said the lead investigator of the recent study, Dr Ronald Melki, director of research at the Paris-Saclay Institute of Neurosciences, CNRS. "These observations suggest that fibrillar α-Syn is not innocuous."

In order to assess the best methods to remove and disassemble α-Syn seeds, Dr Melki's team applied a solution of fluorescently labelled fibrils and ribbons of α-Syn to roughened surfaces mimicking laboratory conditions. Five cleaning solutions were tested — sodium hypochlorite (20,000 ppm); sodium hydroxide (1N); sodium dodecyl sulfate (SDS, 1%, W/V); Hellmanex (1%, V/V); and TFD4 (1%, V/V) — with the results published in the *Journal of Parkinson's Disease*.

The researchers found that the commercial detergents Hellmanex and SDS (1%, W/V) are the most suitable cleaning reagents for removal and neutralisation of α-Syn seeds from contaminated surfaces. Solutions of sodium hypochlorite (20,000 ppm) or sodium hydroxide (1N), previously shown to diminish prion infectivity, were ineffective, as was plain water (used as a control).

"We conclude that cleaning procedures relying on the use of detergents that are compatible with most non-disposable tools in a laboratory are simple to implement and highly recommended when working with fibrillar α-Syn in a laboratory setting," said co-investigator Dr Patrik Brundin, editor-in-chief of the *Journal of Parkinson's Disease* and director of the Center for Neurodegenerative Science at the Van Andel Research Institute, Michigan.

"The procedures we describe remove and inactivate α-Syn fibrillar assemblies to a level where they are undetectable, which significantly improve researchers' safety when handling fibrillar α-Syn," added co-investigator Dr Luc Bousset from the Paris-Saclay Institute of Neurosciences. "Further work is needed to establish the infectious unit of recombinant α-Syn and the biological efficiency of the cleaning."

Science-grade camera

Capturing temperature readings from fast-moving objects is a major challenge for researchers in the scientific community. The X6900sc science-grade camera from FLIR has enough speed and resolution to make this possible.

The product is a high-speed mid-wave infrared (MWIR) commercial camera with a frame rate of 1000 fps and a 640 x 512 resolution. It provides full-resolution recording to on-camera RAM for up to 26 s to make capturing and processing images easier. The automatic filter system has an easy-access, four-position motorised wheel.

With a sensitivity of less than 20 mK and temperature readings up to 2000°C, the camera offers the advantages of a fast frame rate and high resolution without compromising sensitivity. Whether the user is trying to measure temperatures on fast-moving objects or characterising the thermal transient of objects as they cool, it provides a suitable thermal measurement solution for the job.

FLIR Systems Australia Pty Ltd
www.flir.com.au

Nanoparticle tracking analysis concentration measurement upgrade

The Malvern NanoSight provides an easy-to-use, reproducible platform for nanoparticle characterisation. Using nanoparticle tracking analysis (NTA), single particles can be measured for size and concentration.

A wide range of applications can benefit from NTA analysis, including nanoparticle production, nanoparticle toxicology, exosome and micro vesicle research, protein aggregation, drug delivery and vaccine development. A fluorescence mode also enables detection of labelled particles.

Benefits of NTA include minimal sample preparation, visual validation of results and user-friendly software with easy set-up of SOPs for routine use. The high-resolution particle sizing technique is suitable for polydisperse systems.

Driven by the growing popularity of the technique, an upgrade has been developed. Measurement of concentration has been modified to reduce user input, reduce variability and provide interlaboratory consistency in size and concentration measurements.

The upgrade has enabled improved robustness, precision and reproducibility of concentration measurement on a wide range of nanoparticle types for a broad size and concentration range. It can be coupled with DLS to extend the measurement range to below 1 nm and measure particle stability (or zeta potential). The upgrade is available for NS300 and NS500 systems and requires a syringe pump and NTA 3.1 software.

ATA Scientific Pty Ltd
www.atascientific.com.au

Peristaltic cased pump for bioprocessing tasks

Watson-Marlow Fluid Technology Group has introduced its 530 peristaltic cased pumps for single-use bioprocessing applications. The pumps bring security and control to upstream and downstream bioprocessing tasks, including fermenter feed and depth filtration.

Peristaltic technology is suitable for biopharm applications as the pumped fluid is totally contained within the tube, thus providing complete isolation of the fluid. The technology also offers low-pulse flow and gentle, low-shear operation to help maximise live cell retention.

The product's enhanced operator and control system interface contributes to step-change improvements in validated process security. Added features include colour HMI display and intuitive menu structures that provide visual status indication and minimal key presses. Users and process engineers will also benefit from process security with the addition of a three-level PIN lock.

The versatile pumps deliver flexible system integration by offering four drive options, enabling users to choose from straightforward manual operation to fully automated control. This includes the ability to link up to 16 pumps and provide real-time communication.

The pumps deliver flow rates from 0.0001 mL/min to 3.5 L/min at up to 7 bar, thereby simplifying process scaling. It is the pump head which determines both the flow rate and the pressure that can be achieved to match the needs of the specific biopharm process. The pump supports full integration with other equipment such as bioreactors, while IP31 and IP66 protection options make it suitable for all environments.

Watson-Marlow Fluid Technology Group
www.wmftg.com.au

Media for culturing CHO cells

Lonza has launched PowerCHO Advance Media, the latest addition to the company's range of specialised, chemically defined, serum-free media for culturing Chinese hamster ovary (CHO) cells.

The media line offers easy filterability, improved cell-growth promotion and high protein titres. In addition to being hydrolysate-free, serum-free and of non-animal origin, the media offerings are enhanced to better support high-density CHO cells in suspension. For therapeutic bioprocessing applications, the medium also facilitates both downstream purification and regulatory compliance.

The media allow for easy scalability, so users do not need to change to a new medium as they progress from research projects through to large-scale production. The medium is also fully chemically defined, which eases the regulatory process when transitioning from research into clinical trials and US FDA submission.

The balanced formulation allows users to maintain high viability (greater than 90%), even at high cell densities, and is said to provide higher protein titre when compared with other media formulations on the market. The cell culture media can be used throughout the research process and beyond.

Lonza Australia Pty Ltd
www.lonza.com

Bench meter

Backed by OHAUS's commitment to providing precise measurement, the Starter 5000 provides pH and ORP measurement for high-level experiments and research.

The bench meter combines enhanced features, advanced technology and high performance to support complex laboratory tasks requiring pH measurement. Its performance is propelled by a 1000-item library, 10 sensors for calibration storage, eight predefined and one self-defined buffer groups, three endpoint modes and GLP mode.

The colour touch screen operates similarly to smartphones and tablet computers and provides simple operation of the features, such as one-touch toggling of measurement modes. With a standalone electrode holder, USB port, IP54 housing and in-use cover, the meter provides the flexibility and protection that ensures smooth and enduring operation.

Ohaus Australia
www.ohaus.com

Photometric converter

The Haze Control 4000, from optekis, is a powerful, microprocessor-based converter. Its modular design has been specifically engineered for high-precision haze (turbidity) measurements.

The menu-based software is easy to use and configure and available in German, English, French, Dutch, Spanish, Russian and Portuguese. The software includes adjustable signal damping, 16 linearisation tables and calculation capabilities. An integrated data logger captures vital process information for quality assurance and plant control records. This data is easily transferred to a PC via an RS232 port.

The photometric converter is designed to operate with the optek DTF16 (11°/90° scattered light sensor) and additionally with AF16 or AS16 visible (VIS) or near-infrared (NIR) based sensors. The graphic display can show absorbance, turbidity and concentration in real time and in any unit of measurement, such as EBC, FTU, ppm (DE), NTU, ASBC and Helms. These measurements may also be displayed as text, bar graphs or trend values. A factory zero point is implemented for the scattered light sensors.

A secondary user zero for additional offset is included, as well as a slope and shift adjustment. This manual adjustment can be used to compensate for long-term, process-related disturbances.

AMS Instrumentation & Calibration Pty Ltd
www.ams-ic.com.au

Direct determination of trace hormones in drinking water

© Mikkel Bigandy/Dollar Photo Club

Endocrine disrupting compounds can now be directly assayed in drinking water without using a solid-phase extraction concentration step.

The exposure of fish, wildlife and humans to water contaminated with trace levels of hormones is causing concern globally as awareness grows about the endocrine disruption potential of such exposure. Endocrine disrupting compounds may interfere with the body's endocrine system and produce adverse developmental, reproductive, neurological and immune effects. The hormones of concern include naturally occurring steroids such as estrone (E1), 17-β-estradiol (E2) and estriol (E3), and synthetically prepared ones such as 17-α-ethynylestradiol (EE2).

The hormones enter the aquatic environment in a variety of ways but primarily through the discharge of treated and untreated sewage water. During wastewater treatment these hormones are susceptible to removal by biodegradation or sorption to sewage sludge, where secondary treatment can consistently reduce concentrations by more than 85%; however, ng/L concentrations of individual compounds may still be present in effluents. Runoff from cattle given some growth promoters and sludge and manure applied to agricultural fields are other sources of hormone contamination.

In North American and European cities, wastewater treatment plant effluent is frequently indirectly re-used as treated water is discharged into rivers which are also a source of drinking water. Consequently, there is the possibility that trace amounts of hormones may penetrate into drinking water even after special treatment processes. Several hormones are routinely monitored by the US EPA in drinking water as part of the Unregulated Contaminant Monitoring Rule (UCMR 3). These include estrone, estriol, 17-β-estradiol, equilin androstenedione, testosterone and 17-α-ethynylestradiol. The European Union has identified a list of priority substances, which includes estradiol and 17-α-ethynylestradiol (Directive 2013/39/EU amending Directives 2000/60/EC and 2008/105/EC).

Both regulations require highly sensitive and selective methods with ng/L or pg/L reporting levels. Previously published methods typically use solid-phase extraction as a concentration step to achieve the regulatory reporting limits; however, this approach adds an additional expense and complexity.

Direct analysis of hormones in water regulated by EPA Method 539 and UCMR 3 is now possible. The integration of a high-volume injection cycle with a highly robust and sensitive MS/MS detection system has resulted in an effective solution for routine hormone analysis in drinking water without the need for extensive sample preparation using conventional SPE methods.

Method development

Previously published methods for the analysis of endocrine disruptors have used ammonium hydroxide as the mobile modifier and it is the currently recommended approach in EPA method 539.

In this study, ammonium fluoride was tested at different concentrations (0.1, 0.2, 0.3 and 0.5 mM)

in the aqueous phase, with methanol used as the organic phase. Improved response was observed for all hormones using ammonium fluoride, in comparison to ammonium hydroxide, as is shown in Figure 1. The optimum concentration was determined to be 0.15 mM, which is consistent with the results of others. Ammonium fluoride (approx. pH 6) offers further benefits in comparison to ammonium hydroxide (approx. pH 9.5) as the lower pH means that analytical columns, other than those stable at high pH, can be employed.

Methanol was used as the organic solvent, although acetonitrile resulted in a marginal improvement in signal to noise for compounds responding in negative ion; but this advantage was countered by a marked reduction in the positive ion response.

As the panel of target compounds resulted in an optimal response in both positive and negative ion detection, a rapid polarity switching method was used in routine analysis without compromising data quality or response (Figure 2).

Key points in enhancing EPA method 539

0.15 mM ammonium fluoride generated higher sensitivity compared to ammonium hydroxide. Heated electrospray further enhanced sensitivity and a 5 ms polarity switching optimised the hormone panel detection.

Linearity was investigated over an eight-point calibration curve in drinking water, analysed in duplicate, covering two and a half orders of magnitude. Peak area repeatability (n=7) was assessed at low (level 2) and high (level 5) concentrations. The robustness study was performed using drinking water spiked at level 5.

Hormone limits of detection were calculated based on the method described by the EPA Method 539 using a standard deviation of 7 replicates at a concentration value that corresponds to an instrument signal-to-noise ratio in the range of 2.5 to 5 and a Student's t 99% confidence interval.

Method validation

In order to test the performance of the developed method, limits of detection, linearity, repeatability (low and high concentrations) and longer term robustness were assessed.

Linearity was assessed from 0.5 x the required reporting level to 100 x times the reporting level. The concentration for each compound in spiked drinking water is listed in Table 1.

All seven hormones achieved excellent correlation coefficients R2>0.999 using a weighted (1/C) least squares regression analysis. Hormone limits of detection were calculated based on the method described by the EPA Method 539. Using the developed method on the Shimadzu LCMS-8050, detection limits ranged from 0.0058 ng/L for testosterone to 0.33 ng/L for 17-α-ethynylestradiol.

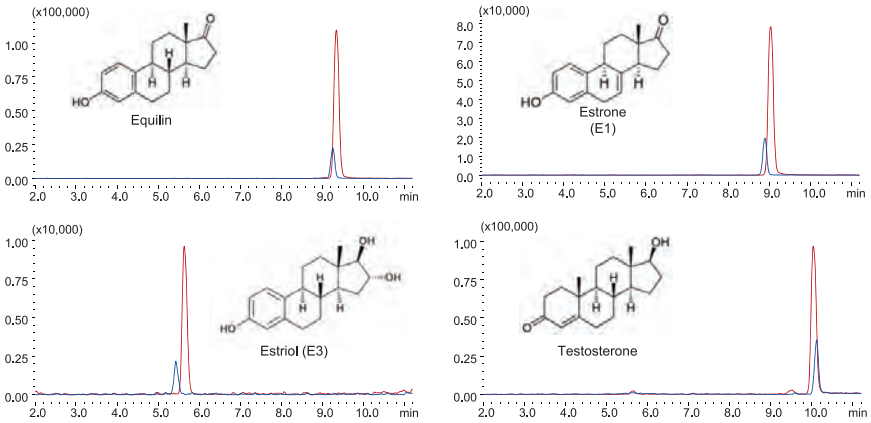


Figure 1: A comparison between the response generated using NH4OH (blue trace) and NH4F (red trace). NH4F delivers an increased signal-to-noise ratio for all compounds (for example, Equilin x4.0, estrone x4.8, estriol x4.5 and testosterone x2.8).

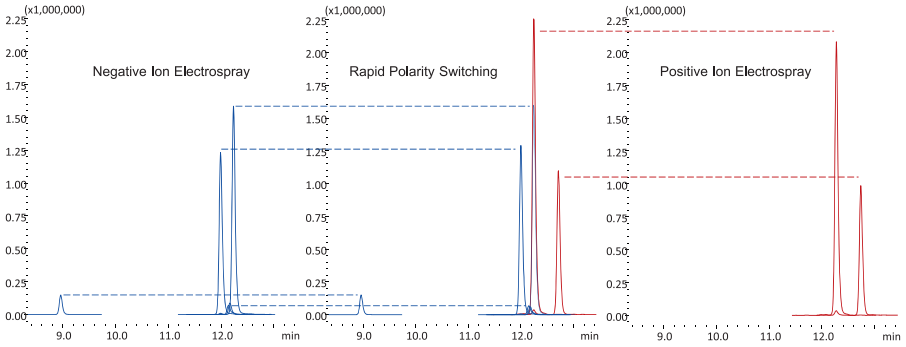


Figure 2: Rapid positive/negative switching using a 5 ms switching time results in the highest data quality for all target hormone compounds in a single analysis.

Compound	Level 1 (ng/L)	Level 2 (ng/L)	Level 3 (ng/L)	Level 4 (ng/L)	Level 5 (ng/L)	Level 6 (ng/L)	Level 7 (ng/L)	Level 8 (ng/L)
Equilin	2	4	8	20	40	80	200	400
Estrone	1	2	4	10	20	40	100	200
17-α-ethynylestradiol	0.45	0.9	1.8	4.5	9	18	45	90
Estriol	0.4	0.8	1.6	4	8	16	40	80
17-β-estradiol	0.2	0.4	0.8	2	4	8	20	40
Androstenedione	0.15	0.3	0.6	1.5	3	6	15	30
Testosterone	0.05	0.1	0.2	0.5	1	2	5	10

Table 1: Concentration of each compound in the calibration series in drinking water.

Conclusion

A fast, selective and highly sensitive method has been developed for the measurement of hormones in drinking water. By integrating a direct high-volume injection cycle with a fully optimised LC/MS/MS method, the LCMS-8050 delivers precise and accurate detection limits regulated by EPA method 539 and is in accordance with UCMR 3.

The LCMS-8050 triple quadrupole mass spectrometer method delivered high sensitivity with detection limits ranging from 0.005 ng/L (testosterone) to 0.330 ng/L (17-α-ethynylestradiol). Correlation coefficients for all compounds were greater than 0.999 and peak area repeatability was determined to be typically less than 5%RSD at 'low' (corresponding to the reporting level) and 'high' concentrations.

This article is based on 'Direct Determination of Trace Hormones In Drinking Water By Large Volume Injection Using The LCMS-8050 Triple Quadrupole Mass Spectrometer' by David R Baker and Neil Loftus, Shimadzu Corporation, Manchester, UK. Read the article at https://shimadzu.com.au/hormones-drinking-water-lcms-8050-triple.

Shimadzu Scientific Instruments (Oceania) Pty Ltd
www.shimadzu.com.au

Like a drone over troubled water

Start-up company Drones Over Water, founded in 2015 by Adelaide entrepreneur Dan Squire, is developing drones to collect and test potentially dangerous water samples from dangerous or difficult-to-access environments such as reservoirs, chemical spills, wastewater plants, tailings dams and ocean oil spills.

The drones are capable of flying — either autonomously or with the help of a pilot — to a programmed GPS position and collecting a sample from a specific depth, using an attachment that hangs below the drone. Squire explained, "When you lower it to a certain level the attachment opens up, takes a water sample at that level, it closes and flies the sample back."

The drone can test the sample on board or a variety of parameters, including temperature, pH, conductivity and redox. This data can be sent to the people who need it.

"At the moment we just save it on an SD card, but in the future, either through Wi-Fi or a 3G connection, we'll be able to send it straight to the cloud and someone can access it basically as it's happening," Squire said.

Squire last year won first prize at the Flinders University New Venture Institute eNVIes awards. His prize included a $5000 travel scholarship to Austin, Texas, which he plans to use to pitch his idea to potential investors or business partners. If an investor is found in the coming months, Squire aims to launch a product before the end of the year and possibly offer a service even sooner.

"I think the water industry is going to be our main customer, followed by probably environmental, mining and also emergency, such as for a chemical spill or a spill on the ocean where you can't put people's lives at risk to go out and monitor that water if it is dangerous," he said.

"A the end of the day, there's no-one standing on the edge of a boat or on the edge of the water to be endangered. You can also go out to watercourses that people can't go out on, like in the mines."

This is a modified version of a news item published by The Lead South Australia under Creative Commons, with additional information from Flinders University Marketing and Communications.

Wi-Fi temperature and humidity monitoring

Monitoring temperature and humidity is particularly important where incorrect climatic conditions can have drastic consequences, such as in pharmaceutical and health applications. Testo's Saveris 2 is claimed to make temperature and humidity analysis both easier and more accurate than ever before.

The Saveris 2 system allows the user to get up and running with a single logger monitoring up to two devices and add new loggers into the system as needed. By using a cloud-based monitoring system, the product allows information to be stored and accessed remotely. This means users can monitor and react to issues from anywhere in the world, via PC, tablet or smartphone.

The unit can also measure temperature and humidity values of sensitive goods and products in processes and during transport. The easy-to-use measurement system delivers safety and savings in time and costs due to automated measurement data recording. Freezers and fridges, for example, can be continuously monitored and the data will be automatically collated and sent to the user as a daily, weekly or monthly report via email.

The cloud licence includes unlimited email alerts and 25 SMS alerts per logger per year. Additional SMS bundles are available for purchase. Basic cloud licensing is completely free of charge and, for a limited time, the company is offering a free advanced cloud licence with added features.

Capella Science
www.capellascience.com.au

Peristaltic pumps for the biopharma industry

Watson-Marlow Fluid Technology Group has supplied peristaltic pumps to Novasep for the latter's Sius TFF Skid, a tangential flow filtration system used in the biopharmaceutical industry to separate and concentrate biomolecules according to their size. The skid is said to be the first on the market to offer a 100% single-use tangential flow filtration (TFF) solution, covering all tangential filtration requirements — from the R&D stages through to commercial production.

In tangential flow filtration, the fluid to be processed circulates across a porous membrane and, under pressure, passes through its pores. Molecules of a greater size than the pores remain in the retentate, whereas small molecules pass through the membrane into the permeate. The retentate circulates continuously in a loop travelling across the membrane which, for example, enables the molecules to be concentrated or facilitates buffer exchange (diafiltration).

The skid's recirculation loop (retentate) is fed by a Watson-Marlow 520UN/R2 continuous tubing pump as part of diafiltration. A 620UN/RE LoadSure tube element pump is used to recirculate the retentate within the loop, providing low-pulse flow rates and a linear 4 bar displacement pressure, to enable easy setting of the system rentate valve.

The two pumps ensure cells are undamaged through excessive heat transfer and unwanted particulates are not introduced into the fluid stream. Furthermore, peristaltic technology eliminates cross-contamination risks.

"In this type of application, purity and quality are key factors," said Jerome Chevalier, process engineer at Novasep. "Therefore, the cleaning phases are very important in order to ensure that the equipment complies with hygiene specifications. The Watson-Marlow pumps' tubing provides high-purity, USP Class VI validated contact materials."

Watson-Marlow tubes are pre-sterilised (gamma-irradiated) so that the user can eliminate the cleaning and validation phase without risk of contamination. This saves time and has a direct effect on operating costs.

"The second advantage of Watson-Marlow pumps is that they offer a high degree of precision, even at higher pressures," added Chevalier. "This has enabled us to leave out the flow meter that we had planned originally."

Watson-Marlow Fluid Technology Group
www.wmftg.com.au

Powder flow measurement with a rheometer

The Anton Paar Powder Cell, for the MCR rheometer series, brings an array of traditional rheological methods to the field of powder. The product makes it possible to simulate and determine powder flow under different conditions. An MCR rheometer plus a Powder Cell is a suitable combination for true rheological investigations of powders in quality control as well as research and development.

The product combination can simulate and determine powder flow under different conditions; it therefore ensures efficient quality control and smooth powder processing. It can furthermore determine a powder's cohesion strength — the internal resistance of the powder to flow — making it possible to predict whether a powder will flow through a process smoothly and whether the quality of a powder has changed.

The device delivers reproducible results by clearing the 'powder memory' with fluidisation. An automatic measurement program ensures results within 2 min and therefore high throughput. The product is easy to use, providing automatically performed calibration and live visualisation of the measurements. Operating costs are said to be low and the dust protection hood safeguards the operator and the instrument from fine and potentially hazardous powder.

More than just an instrument for quality control, the product also enables the study of dry granular flows, especially in the fluidised or near-fluidised state. It brings the precision achieved with MCR rheometers to the field of granular media. It not only includes a high-precision pressure-drop device, but also enables rotational and oscillatory tests in any state of consolidation, fluidisation or any state in between. The included precision mass flow controller gathers new data between zero-load and the fluidised state.

MEP Instruments Pty Limited
www.mep.net.au

Heat stabilisation technology

Denator has developed an additive-free heat stabilisation technology that permanently preserves the quality of biological samples. Biomarkers, peptides and post-translational modifications, such as phosphorylated and acetylated proteins, are preserved as close to their in vivo state as possible throughout the entire workflow.

The stabilisation technology utilises rapid conductive heating to generate a fast, homogenous thermal denaturation of proteins. This results in complete inactivation of enzymes (such as proteases, peptidases and phosphatases) that would otherwise cause further changes to the sample ex vivo. Commercially available enzyme inhibitors are, on the contrary, said to be ineffective in removing all enzymatic activity.

Scientex Pty Ltd
www.scientex.com.au

Add-on for project management software

The Project Success Toolkit is an add-on for the project management software Microsoft Project. The toolkit is said to improve the functionality of any off-the-shelf version and allows the user to easily utilise the full range of the software.

The toolkit adds functionality to Project to allow an activity's owner to specify its duration and amend it if necessary. Project's plans are updated using percentage complete figures. The toolkit also adds the ability to update plans using the estimated remaining duration or estimated completion date.

All activities are allocated to an Activity Manager. The toolkit's Group and Sort function lets the user group activities by manager, letting the user see what each person is responsible for. An Activity Update form lets people report progress to their manager.

The Look Ahead report can be used by the project manager to remind Activity Managers about activities due in the next work period. The Project Metrics report, meanwhile, contains metrics like the average activity duration, missing predecessors and successors, the percentage of tasks on the critical path, total slack and projected finish date.

Project Success, Inc.
www.projectsuccess.com/

Label-free, real-time cell analysis

The xCELLigence Real-Time Cell Analyzer (RTCA) from ACEA Biosciences allows for label-free monitoring of cellular processes such as cell proliferation, morphology, cytotoxicity, adhesion, viability, invasion and migration. Using an electronic cell sensor array technology, the system provides precise, physiologically relevant, quantitative data recorded throughout the entire course of an experiment.

The ability of different immune cells to cause targeted cytolysis of cancer cells is an exciting area for immunotherapy research. Utilising the power of the xCELLigence RTCA systems, researchers are able to investigate the short- and long-term cytotoxic effects on target tumours using a wide range of immune cell types, including natural killer (NK) cells, T-cells, CAR-T cells and macrophages, as well as the effects of antibody-dependent cell cytotoxicity (ADCC) and bispecific T-Cell engagers (BiTE) antibodies. Real-time kinetic cellular profiles generated provides reproducible, publication-ready data from a single experiment.

The system also enables a wide range of applications, including: cell invasion and migration; compound- and cell-mediated cytotoxicity; cell adhesion and spreading; cell viability, proliferation and differentiation; receptor-mediated signalling (GPCRs, RTKs); virus-mediated cytopathogenicity; cardiotoxic compound effects; and continuous quality control of cells in culture.

In Vitro Technologies Pty Ltd
www.invitro.com.au

Micro-ohmmeter

Having a lightweight digital low resistance ohmmeter (DLRO) is important for HV test engineers on the go, as power losses and rising temperatures often lead to serious trouble. The 1 kg Megger MOM2 micro-ohmmeter, available to rent from TechRentals, is designed to run all day without needing a recharge and measures resistance with a resolution as low as 1 $\mu\Omega$.

The product uses the DualGround method, meaning that the test object will be grounded on both sides throughout the test without affecting the results. This provides a safe, fast and easy workflow and shifts focus to the test rather than the equipment.

The unit stores 190 test values with easy transfer to PC via Bluetooth. It has an auto range of 1 $\mu\Omega$ to 1000 mΩ. The display offers both analog arc and a dual digital readout. Kelvin probes are also included in the rent for a 4-wire Kelvin test.

TechRentals
www.techrentals.com.au

Precision balance

Mettler-Toledo's stable, durable and easy-to-clean XPE Precision Balance offers good repeatability when weighing minute forces without use of a draft shield.

The star-shaped SmartPan weighing pan, which is integrated into the balance, fosters repeatability at resolutions down to 1 mg while delivering results up to twice as fast as a comparable balance using a draft shield. Elimination of the draft shield makes weigh-in quicker and easier. This serves to enhance lab productivity and help operators to have a more comfortable weighing process.

The weighing pan design is said to maintain a faster-than-average settling time inside a fume hood, where continuous drafts are used to eliminate the danger posed by airborne gas or other toxins. Under these subtly more difficult conditions, XPE Precision 5 and 10 mg models in particular continue to deliver results up to twice as fast, with the balance's two-fold improvement in repeatability, without resorting to draft shield use.

Mettler-Toledo Ltd
www.mt.com

Should I eat the vegetables I grow in my backyard?

Measuring industrial contamination

Industrialisation has left much of the urban environment contaminated with a variety of heavy metals, chemicals and pesticide residues. Research by a team from Macquarie University has produced a series of maps that plot the concentrations of metal pollutants across cities like Sydney and Darwin, and towns such as Mount Isa and Port Pirie.

Results of the survey indicate the spread of contamination in many ways reflected the growth of major cities, with the highest concentrations in older suburbs. The contaminant of most concern across Sydney backyards is lead. It would be expected that there would be contamination in a major city explained the director of the Macquarie team, Professor Mark Taylor. "We live in an industrial environment. We have used lead-based petrol and paint for most of the 20th century."

One technique for measuring levels of contaminant metals that is key to the work being conducted by the Macquarie team is X-ray fluorescence spectrometry (XRF). Simple screening for toxic metals is performed by placing an analyser — such as the Delta Premium from Olympus — directly onto soil or dust. The analyser provides detection of metals for site characterisation, contamination tracking, remediation monitoring and property evaluations.

The latest portable X-ray fluorescence (pXRF) analysers, such as the Delta Premium, have been developed specifically for complete environmental investigations of metal contaminants in a wide range of industrial and domestic materials. The high-power, high-performance, rugged unit allows in situ analysis in a wide range of harsh environments from remote mining and exploration sites to backyards in major urban centres.

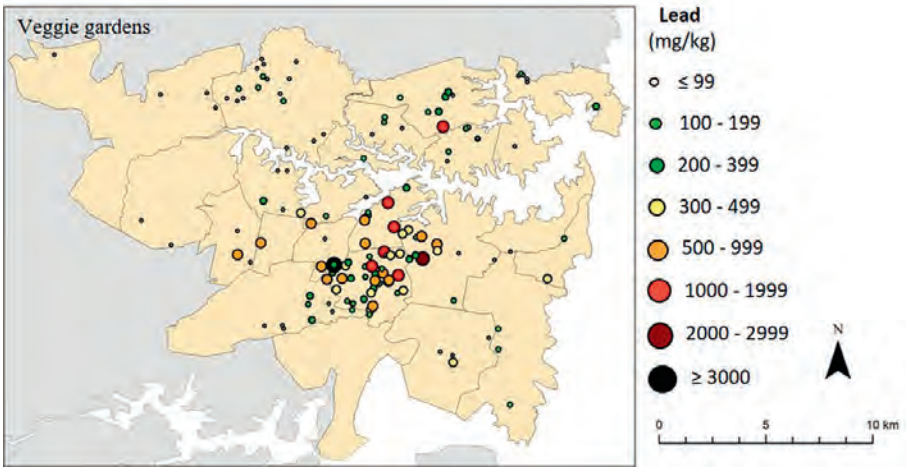
The latest model Delta unit offers increased speed and improved sensitivity. It also lowers the limit of detection (LOD) for challenging elements such as cadmium, barium, lead, mercury and tin.

According to Andrew Saliba, regional sales specialist with Olympus, the traditional use of pXRF has been for alloy identification, grading ore, mineral exploration, metallurgy and mine site remediation. "The technology has been refined and is now often used by environmental consultancies specialising in contaminated land remediation and recycling companies needing to determine what materials are in waste products," he said.

Macquarie researcher Marek Rouillon has been working to evaluate the reliability and repeatability of XRF analysis on environmental samples. Professor Taylor and Rouillon regularly present their findings at seminars, outlining the spread of heavy metal contamination in suburban gardens in addition to explaining the application and relevance of the pXRF instrument for this project.

Typical 'natural' or 'background' concentrations of lead for the Sydney region are in the range 20–30

The compact, lightweight Delta Element hand-held XRF analyser from Olympus.



Soil lead concentrations in 141 vegetable gardens in Sydney, Australia. (© Macquarie University, 2015)

A technician analysing soil samples in a public park.

mg/kg or parts per million (ppm). However, due to the intense use of lead-containing products, much of Greater Sydney has been contaminated with the metal. Their results indicate Sydney residences have a mean soil lead concentration of 220 mg/kg, which is approximately 10 times the typical natural background for Sydney's soils and rocks.

In 2012, the Centres for Disease Control and Prevention in the USA stated that there is no safe blood lead level for young children. Prior to this, health authorities around the world had issued guidelines for 'acceptable' levels of lead contamination, but surveys and reports have shown that even at the lowest levels there were health effects in children, including impaired brain development and behavioural disorders.

In conjunction with the contamination mapping, Macquarie researchers also run the community-orientated VegeSafe program. This is the largest study of its kind in the country and has provided information about metal contamination levels to more than 500 households across Sydney, and over 1000 households across Australia.

VegeSafe seeks to inform people about metals and metalloids in their garden soils and provides a free sampling program for domestic and community garden soils. Participants submit soil samples from private or community gardens and receive a formal report and links to information and advice about 'what to do next' if the soils contain elevated concentrations of metals and metalloids. "The VegeSafe motto is 'Carry on Gardening'," Professor Taylor said, "because this is exactly what we want people to do knowing that their soils are metal-free as is the produce from their gardens."

According to Rouillon, the simplest mitigation technique for householders would be to cover the contaminated soil with either grass or mulch, to effectively reduce the potential generation of dust if the soil is dry and gets picked up by wind.

In contaminated suburbs where vegetables will be grown, the Macquarie team recommends growing produce in above-ground vegetable plots, using fresh clean topsoil. "Typically, undisturbed soil in urban areas accumulates contaminants over long periods of time and should be avoided when growing home produce," Rouillon stated.

"Our recommendations are determined by different scenarios and contaminant concentrations," Rouillon said. "VegeSafe provides specific recommendations and advice to a gardener for their particular situation."

Other uses of pXRF analysis include extreme-weather debris migration studies, agriculture soil inspections, and construction and demolition waste sorting. A further use is as part of hazardous waste screening for disposal classification.

The Macquarie team

Director of the Macquarie team is Professor Mark Taylor, an academic and former commissioner of the NSW Land and Environment Court. Senior researcher Marek Rouillon and the rest of the group investigate environmental pollution and risks to human health from aerosols, dusts, sediments, soil and water. The team works in a range of locations across Australia, including Broken Hill, Mount Isa, Newcastle, Port Pirie, Sydney and Townsville.

Professor Taylor also provides expert evidence and advice to government, industry, lawyers and community groups on a range of environmental matters, particularly environmental pollution. He has also written more than 100 research papers and reports that have been published in peer-reviewed journals, in addition to articles for magazines and newspapers.

Olympus Australia Pty Ltd
www.olympusaustralia.com.au

XRF system for analysing chlorine in crude oils

PANalytical has announced a dedicated solution for the analysis of very low chlorine concentrations in crude oils. Epsilon 3XLE, an XRF benchtop system, has been equipped to meet the analytical challenges of the petrochemical industry.

Chlorine and sulfur are unwanted elements in crude oil and other petrochemical products. They can cause corrosion in the oil processing and refinement installations and are harmful for the environment. XRF is widely used for the analysis of sulfur in oil; however, the simultaneous determination of very low chlorine concentrations poses an analytical challenge due to the proximity of both elements in the periodic table of elements. PANalytical's Epsilon 3XLE energy dispersive X-ray fluorescence spectrometer is able to meet this challenge.

The combination of a chromium-anode tube, good resolution and sensitivity of the silicon drift detector and the powerful software enables the system to process high sulfur count rates and at the same time resolve possible line overlaps between chlorine and sulfur. Crude oil samples are simply poured into disposable cups for liquid samples before being measured by the compact benchtop spectrometer.

The system caters for variable characteristics of crude oil composition, thereby enabling the robust determination of chlorine. It can also analyse all other relevant elements with similar repeatability, making it a valuable asset for a wide range of petrochemical applications.

PANalytical
www.panalytical.com

An advanced system for high-density *E. coli* fermentation

Eppendorf has demonstrated the use of the BioFlo 320 bioprocess control station to achieve ***E. coli*** cultivation. The company's experiment saw the ***E. coli*** K-12 strain grown in a 1 L (working volume) stainless steel dish-bottom BioFlo 320 glass vessel.

The product has been developed for both microbial fermentation and cell culture applications. It features an industrial design, flexibility between autoclavable and single-use vessels, intelligent sensors, ethernet connectivity and an improved software package.

An optical sensor was chosen for dissolved oxygen (DO) control in the experiment, since the control station is compatible with multiple types of DO sensors. One of the advantages of the optical DO sensor is that it does not require the 6 h polarisation time of a traditional polarographic DO sensor, which reduces the turnaround time between fermentation runs.

The BioFlo 320 software offers a selection of automatic gassing control cascades that are dependent on the configuration of the unit. This particular experiment utilised the automatic gas mix and four thermal mass flow controllers (TMFCs) with a flow range of 0–20 SLPM. The DO setpoint was 30%.

Samples were taken periodically to monitor the cell growth (OD600 value), glucose concentration, wet cell weight (WCW) and dry cell weight (DCW). Feeding was initiated when the glucose concentration dropped below 2 g/L, which occurred at 5.25 h of cultivation. Both WCW and DCW increased proportionally with the increase in OD600 value, which reached 215.2 within 12 h.

The Eppendorf BioFlo 320 bioprocess control station was thus able to support high-density ***E. coli*** growth using a fed-batch fermentation method.

Eppendorf South Pacific Pty Ltd
www.eppendorf.com.au

Evaporator system for academic multi-user environments

Designed to concentrate or completely dry samples, the EZ-2 from Genevac is an evaporator used by academic groups in chemistry, pharmacology, biology, natural product and environmental science departments worldwide. Benefiting from a suite of preprogrammed methods, the evaporator is particularly suitable for multi-user environments.

Running the evaporator is an intuitive process: just load the samples, select the maximum safe temperature, select the solvent type and hit start. Offering unattended operation, the product requires no user training — even a beginner can competently use the system within 5 min.

Durably constructed and with the option of HCl-resistant components throughout the evaporation pathway, the evaporator is safe for student use. It is also compatible with a wide selection of sample holders, enabling evaporation from common sample container formats including round-bottom flasks up to 500 mL, tubes up to 150 mm long, vials and custom reaction blocks, as well as shallow and deep-well microplates.

Benefiting from a high-performance scroll pump that delivers deep vacuum, the EZ-2 Elite evaporator is able to routinely remove even high-boiling-point solvents such as DMSO and NMP. In addition, internal heating of vapour duct and system components ensures that solvents only collect in the SpeedTrap condenser and not anywhere else. The condenser comes with the benefit of automatic defrost and drain technology.

Scitek Australia Pty Ltd
www.scitek.com.au

Videoscope

The Series C videoscope, from Olympus, is designed to provide quick and easy inspections in difficult-to-reach areas. The product features image processors that can operate in low light levels and resolve fine detail such as corrosion, burrs and small defects or cracks.

The videoscope allows an operator to inspect areas that have access ports down to 6.2 mm and captures a clear image by combining eight brightness settings, glare reduction, high-intensity LED and light-sensitive CCD camera chip technologies. The carrying case holds everything needed for the majority of inspection projects.

The entry-level videoscope provides good articulation, durability and optics to get the image required. Ergonomically designed to fit in the palm of either hand and weighing less than 1 kg, the portability, durable construction and ease of use mean the product can be used for remote inspections for the full 120 min battery life — and even longer when connected to mains power.

The instrument is built for use anywhere and packed with special features. Designed for long product life, it includes an abrasion-resistant insertion tube with a tungsten outer braid. The spring neck design of the distal end reduces stress when navigating through tight bends. The protective cap on the distal end can easily be replaced, resulting in more inspections being done with minimum downtime.

Olympus Australia Pty Ltd
www.olympusaustralia.com.au

Adam Florance

Sonar mapping

inside Antarctic glaciers

For the first time, a team of Australian researchers has taken the technology used to look into lake and ocean floor sediments and repurposed it to map the internal structure of an Antarctic glacier. The team from Tasmania's Australian Maritime College are using multibeam sonar technology to try and understand the dynamics of Antarctic ice shelves and the ways they are melting and refreezing.

The AMC's Dr Alex Forrest, postgraduate research student Karl Manzer and AUV Junior Engineer Isak Bowden-Floyd joined a month-long expedition to the Drygalski Ice Tongue in McMurdo Sound aboard the icebreaker RV *Araon*, belonging to the Korea Polar Research Institute.

Mapping the internal fractures and determining the distribution of glacial ice and frazil or marine ice is aimed at improving understanding of the processes involved in the melting of Antarctic ice shelves and aid in the development of the Antarctic Gateway Partnership's new autonomous underwater vehicle (AUV).

The Antarctic Gateway Partnership is a Special Research Initiative of the Australian Research Council involving the Australian Antarctic Division, CSIRO and the University of Tasmania.

The AMC team used the multibeam sonar to survey a section of the Drygalski Ice Tongue's submerged side wall at distances of 100 and 600 metres providing different scales of resolution, as well as a sub-bottom profiler to delve 80 metres into the internal structure of the glacial ice. This is the first time that this technology has been repurposed in this way and the AMC team believe that their research will show that mounting a sub-bottom profiler to the autonomous underwater vehicle under development by the Antarctic Gateway Partnership will help provide new insights into glacial structures.

This expedition also allowed the AMC team to test out the performance of the inertial navigation technology that is a serious engineering challenge in the development of long-range AUV operations. At high latitudes, and especially under ice, the AUV is unable to use GPS to determine its position so it is important to understand the limitations that these conditions place on the inertial navigation system.

This is the second time that Dr Forrest has joined one of the Korea Polar Research Institute's expeditions and he looks forward to ongoing, long-term collaboration with them. Other contributors to this project include Antarctic New Zealand, IXBlue, EdgeTech and IXsurvey.

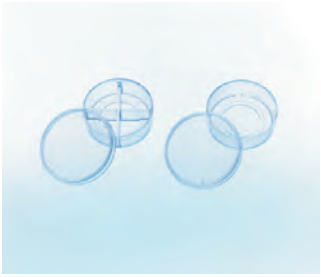
Clinical bioinformatics platform

QIAGEN has announced the launch of the QIAGEN Clinical Insight (QCI) bioinformatics content and software platform for clinical testing labs to interpret and report on genomic variants identified in next-generation sequencing (NGS). The first two supported applications for the bioinformatics platform are in oncology, for somatic and hereditary cancer testing.

The platform is an evidence-based decision support solution that evaluates genomic variants in the context of published biomedical literature, professional association guidelines, publicly available databases and annotations, drug labels and clinical trials. Using a powerful software platform, the secure QCI web application and QIAGEN's private data centre, clinicians can rapidly classify variants, identify treatment options and perform geographical clinical trial matching.

The product supports both germline and somatic test indication, which is important to labs offering diverse test indications. It provides full platform- and assay-agnostic interpretation and reporting workflow support, which enables clinical testing labs to reduce time and cost associated with NGS-based testing. It also provides access to the Allele Frequency Community, a large repository of ancestral and ethnic diversity data.

QIAGEN Pty Ltd
www.qiagen.com



Glass-bottom dish

The Greiner CELLview glass-bottom dish combines the convenience of a 35 mm disposable dish with the optical quality of glass, providing high-resolution microscopic images of in-vitro cultures.

The product's design and embedded glass bottom ensure a single-plane, flat bottom with a consistent working distance, maximal planarity and optimal thermal conductivity in heated platforms, avoiding thermal variations. Dishes are available with standard TC treatment, advanced TC treatment or untreated.

The dish is also available as a subdivided version with four individual compartments facilitating simultaneous multiplex analysis of difference cell lines and various stimulations of diverse transfections. This minimises the amount of required cells and reagents per individual assay.

Interpath Services Pty Ltd
www.interpath.com.au

AppNotes

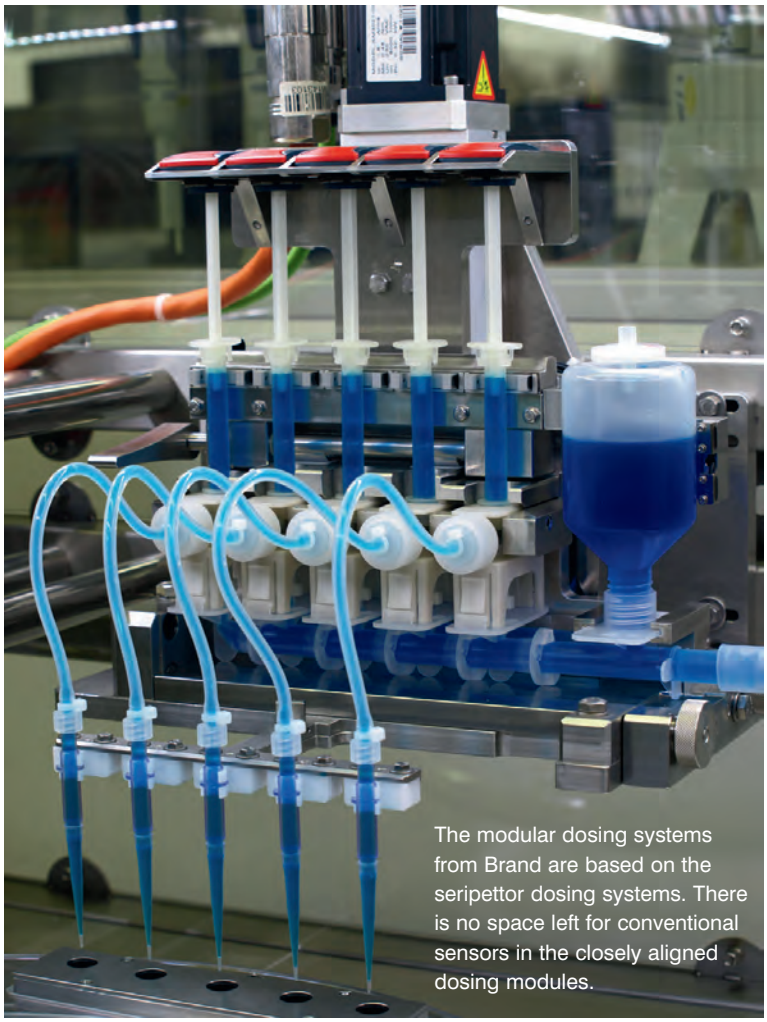
Accurate dosing with photoelectric sensors

The accuracy and function of the high-performance dosing systems from Brand are based on the sophisticated technology of the seripettor bottle-top dispenser.

Brand dosing systems with 2 mL dosing units can dispense even minute volumes accurately. The process reliability is improved by miniaturised MICROmote photoelectric sensors from Balluff.

Due to the need to dispense ever smaller volumes, accurate dosing of aqueous media is a growing challenge in the day-to-day work of a lab. Automated dosing systems are also being subjected to ever greater requirements for accuracy and process reliability. That requires not only more intricate system components, such as dosing units with small volumes, but also sensors designed for the smallest of installation spaces.

"For our 2 mL seripettor dosing unit, we typically specify an accuracy of ±1%, or 0.5 µL, for a target volume of 50 µL of an aqueous, low-viscosity medium," said Eberhard Albrecht, head of Production Technology and Special Purpose Machine Manufacturing at Brand, Germany. He added, however, that this information pertains to standard values. Based on dosing tests with the original medium, even smaller tolerances can frequently be attained for a specific application.



The modular dosing systems from Brand are based on the seripettor dosing systems. There is no space left for conventional sensors in the closely aligned dosing modules.

Seripettor bottle-top dispensers from Brand's line of liquid handling products have been in use for years around the world. They enable easy and accurate dosing of media directly from the supply bottle. An upward movement of the piston fills the dosing unit with liquid, which is dispensed through the dosing cannula by a valve system during a subsequent downward movement of the piston.

"The piston-cylinder principle used here can also be excellently adapted for use in automatic precision dosing systems," Albrecht said. "For many years now, we have been building dosing systems for our own production tasks based on this concept."

The piston stroke systems were first used as the centrepieces of dosing systems with nominal volumes of 10 and 25 mL. But when using small dosing units for dispensing smaller volumes, "the previously used capacitive sensors proved to be unsuitable for reliably detecting unwanted accumulations of air in the cylinder of the dosing unit", Albrecht explained. "Therefore, we needed a new sensor solution."

While researching on the internet, he came across miniaturised photoelectric sensors from Balluff, which impressed him with their small designs and convinced him with their technical characteristics.

The MICROmote photoelectric sensor heads, with dimensions of just a few millimetres, have a rugged metal housing and are operated via separate amplifiers. This makes them suitable for small installation spaces like those in the dosing modules of Brand dosing systems, in which, depending on the design, a different number of dosing units are positioned next to one another in a row. The amplifiers, with convenient indicators and operating elements, are housed outside of the system in the control cabinet. Highly flexible electrical cables provide reliable

Tiny MICROmote through-beam sensors monitor the minimum and maximum levels in the level expansion tank of the dosing modules.

In the centre of the pistons of the small 2 mL dosing units, there is a pin-shaped displacer element; the liquid has to be detected as it goes around this. The emitter and receiver units of the MICROmote through-beam sensors are optimally positioned in the specially designed, fork-shaped housing.

transmission of the signals between the sensor head and the amplifier.

The sensors owe their small size to a patented technology developed in-house for manufacturing micro-optical components, such as LEDs, photodiodes, phototransistors and laser diode units. They are used in many different products with a wide variety of designs; in the case of the Brand dosing systems, the sensors are used as through-beam sensors with modified designs.

"Reliable water detection, which tends to be problematic with other technologies, is ... critical for us," Albrecht said. For this application, the MICROmote sensors use a wavelength in the infrared range at approximately 1480 nm, where water has its maximum absorption. At this wavelength the optical sensors also work reliably for clear water, even if the cylinders filled with liquid are made of semi-transparent material. This simplifies the detection of liquids with high water content. Unwanted accumulations of air in the dosing cylinder, which can lead to inaccuracies in the dispensing volume, are then detected by the absence of liquid. Sensors on the cylinders of the dosing units are located in a fork-shaped housing designed for the special installation.

The company also uses the through-beam sensors in the area of level expansion tanks, which serve simultaneously as a component of the dosing modules for constant system pressure and as an air trap. This is where the minimum and maximum levels are detected. The main container is monitored in the same way. To do so, the tiny emitter and receiver modules are located on the intake tube. If no liquid is detected in the tube, the system is empty.

The MICROmote photoelectric sensors are therefore a suitable solution for applications utilising high-performance dosing systems from Brand. They ensure detection of aqueous media and make a substantial contribution to the compact design in the area of the dosing modules. This makes it considerably easier for the user to exchange individual modules while operation is in progress.

Balluff Pty Ltd
www.balluff.com.au

Where did that foreign body come from?

In the food and beverage industry, foreign body investigations need not be nasty affairs.

Earlier this year, Mars had a foreign body incident that caused the company to voluntarily recall a selection of Snickers, Mars, Milky Way and Celebrations chocolates across 55 countries. This was initiated after just one consumer in Germany reported finding a piece of red plastic in a Snickers bar. After Mars established that the plastic piece came from a protective cover used in the manufacturing process at its Veghel plant in The Netherlands, the company made the precautionary decision to recall all of the 'at risk' product manufactured in the plant. Industry pundits are estimating that the recall will have a significant financial cost attached, certainly running into tens of millions of dollars. The cost comes directly from the recall process, the loss of writing off products and from lost sales in the short and medium term, compounded because the brand damage is occurring in the chocolate boom time in the lead-up to Easter.

Large-scale recalls like this are not good for any company's bottom line or brand image, but in smaller companies the loss of direct revenue, the cost of crisis management, the damage to brand reputation and communications costs are enough to force them into receivership.

You would only instigate this scale of recall if, like Mars, you were satisfied that the problem was genuine, originated in your plant and posed a risk to consumer safety, wouldn't you?

In truth, you can only answer yes to this question if you are absolutely sure of your facts.

'Zero tolerance' is now the norm

Despite the industry's best efforts, it is probably inevitable that foreign particles and matter will periodically be found in food products.

Most raw foods and ingredients originate in a natural environment — a farm, an orchard, a market garden… As the food is picked or harvested, foreign objects such as stones or glass can end up comingled and transported into the processing plant. Additionally, objects found in manufacturing facilities can also find their way into the processing stream. Lastly, fragments of bones, pits or shells that are removed during processing can end up hidden in the final products.

Also, the very processing of the food involves a large number of mechanical devices — there are knives, rollers, conveyors, gears and a plethora of other bibs and bobs required in production. And one thing all mechanical devices have in common is that they eventually wear out and have the potential to be the source of a foreign body incident.

HACCP and GMP plans are designed to minimise the risks of contamination incidents, but control of materials in production environments still presents a major challenge. Consideration needs to be given to the equipment design and certification and design standards which exist to promote hygienic performance (eg, the standards and protocols from EHEDG6, 3-A7 and NSF International8). Adoption of these will mean that your equipment has been designed and constructed to reduce the potential for product contamination or failure.

Added to this, online systems including metal detectors and X-ray inspection can detect and then

prevent many foreign objects from reaching the consumer, but even these can never be a 100% guarantee that a product will be contaminant-free.

Prevention and elimination of foreign bodies

A foreign body incident is not limited to consumers finding something in their food or drink.

A much more positive scenario is when your in-house, online detection systems uncover contaminants. This is a better scenario because the problem has been found and then hopefully solved without the product leaving your plant — so there is no expensive recall and no damage to your brand through unwanted media attention.

A foreign body find in these circumstances can indicate lapses in your quality control systems or be the first indication that a serious contamination incident has already happened.

Whether the contaminant came from an in-house lapse or externally, it is essential that the source of the foreign body be found quickly and conclusively. If the problem is internal, isolating the contaminant source quickly will limit productivity losses and line shutdown time.

Is the foreign body contaminant complaint genuine?

This isn't a silly question. A 2013 study by Glass Technology Services in the UK found that 70% of fragments reported by consumers and submitted for analysis originated from items that are commonly found in the home. It is a sad fact that sometimes consumers fake contamination complaints in the hope of financial gain, notoriety or revenge for a perceived slight.

If manufacturers can establish with surety where the foreign body came from, they can instigate the most appropriate response in a very timely manner.

What can you do?

Rapid and accurate foreign body identification is the first step. Then you need to ascertain where and when a foreign object in food was introduced — your actions will be vastly different if you establish it originated post purchase rather than within the processing and packaging in your plant.

If you have any doubts about the source of the contaminant, you may have to instigate a costly and damaging recall. So anything that helps you to establish the source of the foreign body will be a huge bonus.

X-ray fluorescence technology (XRF) lets users identify the elemental composition of foreign bodies and now, new handheld XRF analysers are moving this technique from the lab to the production line or field. The elemental composition of foreign bodies (down to around 0.5 mm) can be determined very easily with reliable, low-cost, lab-quality information — giving users a 'fingerprint' of the contaminant.

Fingerprint the plant

Even more importantly, the non-destructive technique can be used to establish a 'fingerprint' library of all of the items on the production line.

Once the user has established this library it can serve as a reference to identify the source of a foreign body. If a cutting blade is shearing and leaving metal fragments in your product, you can take a fingerprint of the elemental composition of the fragment, compare this to your library and determine that the blade needs to be replaced.

If your in-house metal detector picks up the contaminant and you identify the source very quickly using XRF, you can implement remedial action immediately. This will minimise downtime and product loss and the risk of contaminated product reaching the consumer.

In one example, a customer has saved hundreds of thousands of dollars through having invested in the fingerprint library of their most critical and problematic lines. In addition to engineering improvements, this has also minimised cost to the food company by holding manufacturing equipment suppliers accountable, having attributed failures to substandard materials such as lower grades of steel.

Equally challenging is internal misdiagnosis of foreign body sources; common without the use of XRF. Many contaminants could not have come from your plant or equipment; these can be quickly detected and you can avoid a large-scale recall or time- and money-consuming shutdown.

More detail about XRF technology

XRF can identify a variety of contaminants such as metals, glass, stones, bones, rubber and hard plastics. One of the major advantages of XRF is that measurements can be carried out on solid samples, avoiding sample digestion-dissolution, and results are available almost instantly.

XRF is a non-destructive analytical technique used to determine the elemental composition of materials. XRF analysers determine the chemistry of a sample by measuring the fluorescent (or secondary) X-ray emitted from a sample when it is excited by a primary X-ray source. Each of the elements present in a sample produces a set of characteristic fluorescent X-rays ('a fingerprint') that is unique for that specific element, which is why XRF spectroscopy is so good for qualitative and quantitative analysis of material composition.

To understand how this information can be used, consider scrap metal. Recyclers need to positively identify numerous alloy grades, rapidly analyse their chemical composition at material transfer points and guarantee the quality of their product to their customers. Metal alloys are designed for specific functions that are not interchangeable; small variations in composition can result in significantly different mechanical properties. Luckily, handheld XRF analysers can easily separate these grades and even create your own unique signatures for future identification purposes.

The X-ray fluorescence process

A solid or a liquid sample is irradiated with high-energy X-rays from a controlled X-ray tube.

When an atom in the sample is struck with an X-ray of sufficient energy (greater than the atom's K or L shell binding energy), an electron from one of the atom's inner orbital shells is dislodged.

The atom regains stability, filling the vacancy left in the inner orbital shell with an electron from one of the atom's higher energy orbital shells.

The electron drops to the lower energy state by releasing a fluorescent X-ray. The energy of this X-ray is equal to the specific difference in energy between two quantum states of the electron. The measurement of this energy is the basis of XRF analysis.

Interpretation of XRF spectra

Most atoms have several electron orbitals (K shell, L shell, M shell, for example). When X-ray energy causes electrons to transfer in and out of these shell levels, XRF peaks with varying intensities are created and will be present in the spectrum, a graphical representation of X-ray intensity peaks as a function of energy peaks. The peak energy identifies the element and the peak height/intensity is generally indicative of its concentration.

Modern software solutions enable rapid element identification and quantification. Additional matching algorithms enable a library to be compared against a contaminant creating a 'hit list' of likely candidates.

Energy dispersive X-ray fluorescence (EDXRF)

EDXRF is the technology commonly used in portable analysers. EDXRF is designed to analyse groups of elements simultaneously in order to rapidly determine those elements present in the sample and their relative concentrations — in other words, the elemental chemistry of the sample.

For more information contact Thermo Fisher Scientific at www.thermofisher.com.au/fbi.

Thermo Fisher Scientific
www.thermofisher.com.au

Pitch your innovative health product idea

Sydney-based company ide Group will be awarding $25,000 worth of product design and development support for the best health innovation product idea pitched at Building Better Futures for Health: A Product Design Challenge. Judged by a panel of medtech industry leaders, the event will take place during the Vivid Ideas Exchange sessions held at the Museum of Contemporary Art on 2 June as part of Vivid Sydney.

The event hopes to attract early-stage entrepreneurs from across Australia with novel product ideas and technologies that have the potential to make a significant difference to people's health. ide Group's co-founder and managing director, George Sidis, explained that it was born out of a desire to support and progress ideas that have the ability to address issues affecting Australia's health in a new and engaging way.

To alleviate the challenges associated with navigating the medtech landscape, ide Group will be awarding the winner of the competition $25,000 worth of services to develop their idea on-site at The Connectory, a workshop and co-working space at the company's headquarters. It will thus provide occupants with ready access to ide Group capabilities and facilities.

"This is a rare opportunity for entrepreneurs to connect with medtech industry leaders, including product design and development experts, to commercialise their ideas in a space fully equipped and supported for the successful, compliant design and development of medical devices," said Sidis.

The challenge promotes itself to be an inclusive event where no idea is too big or too small.

"We want this event to be a celebration of health innovation whilst showcasing a diverse range of medical device product ideas, provide a platform for those ideas to be discovered and enable new industry partnerships to be inspired and developed."

Competition entries are now open and will close on 29 April.

Innovation fund attracting foreign investment, says fund manager

The Prime Minister's $500 million innovation fund has already attracted significant international interest and will attract offshore investment to the country, according to life sciences fund manager Jeremy Curnock Cook.

Curnock Cook said there is a high likelihood that good investment returns will be combined with greater activity in the life sciences sector as long as experienced active managers are used so that they can select companies with lower risk and potentially higher returns.

"There are certainly plenty of Australian companies with excellent, close-to-market clinical trials that will now be able to reach commercial outcomes much faster," he said.

"This money is very welcome and will hopefully provide a template for further investments in coming years."

Curnock Cook added that while the $500 million biomedical translation fund being overseen by Innovation Australia Chair Bill Ferris is making good progress, there are still some details to be ironed out, including the nature of the encouragement that will be offered to attract private funds.

"There are proposals for skewed returns under which the government would get a lower return until the investment is clearly profitable, and for skewed fees, which would see the government bear more of the fees until the fund was in profit," he said.

He said whichever model is chosen, it is important for Australia's superannuation industry to copy its offshore pension fund colleagues and invest more heavily in homegrown health science innovations with clear commercial applications.

"Part of that is coming to grips with the fact that active management fees to invest in this area will always be higher than those applying in other parts of investment markets," he said.

"There are no shortcuts and our hope is that the superannuation funds will be prepared to pay higher fees for the prospect of good performance, as long as managers are also prepared to open up their books in a transparent way and show that this is a real fee for service, not a straight cut."

Curnock Cook said superannuation funds also need to invest in skills and brokers in hiring qualified analysts to identify the best investments in the life sciences sector.

"Without that sort of investment in human infrastructure, one cannot hope to succeed in making the best selections of the opportunities available," he said.

PCR and qPCR kits

Enzo Life Sciences has developed a range of patented DNA and RNA labelling chemistries for genomics research and development. These include RNA and DNA amplification kits, as well as labelling systems and modified nucleotides for creating biotin- or fluorophore-labelled nucleic acid probes for a variety of applications and detection platforms.

The company's range of AMPIGENE PCR and quantitative PCR (qPCR) products is said to enhance the speed, yield and specificity of PCR. Available in a wide variety of formats and compatible with many platforms, the kits have optimised enhancers and stabilisers to improve sensitivity and specificity of amplification.

AMPIGENE qPCR 1-Step Kits contain components needed for convenient cDNA synthesis and qPCR in one tube. The MMLV RTase is optimised for efficient cDNA synthesis, while the qPCR components allow sensitive quantitation. Kits are available in Probe and Green mixes, with varying reference dye concentrations to suit a variety of instrument capabilities.

Sapphire Bioscience
www.sapphirebioscience.com

Blood sampling and storage device

Trajan Scientific and Medical has announced the hemaPEN blood collection and storage device. Harnessing the benefits of dried blood spot (DBS) sampling in a portable format, hemaPEN offers precision blood sampling with the click of a button via its familiar pen design. It can easily be used by anyone, including the young, the elderly and people with disabilities.

The device allows people to collect an uncontaminated and precise volume of their own blood from the fingertip at home, eliminating the need to travel to a medical clinic. This microsample can then be placed in the mail and analysed by a laboratory. Not only does this save time, but the ready-to-use DBS sample is said to enable the laboratory to deliver more definitive test results.

The first iteration of the product provides a DBS format ready for LC-MS analysis. The company is now working on future versions with various interfaces, potentially with in-built sensing technology.

Trajan Scientific Australia Pty Ltd
www.trajanscimed.com

Thermal analysis instruments

Linseis offers thermal analysis instruments for R&D and QC/QA in the plastics sector, chemical industry, inorganic and building materials. The instruments are suitable for determining the thermophysical properties of solids, melts and fluids.

Properties such as heat flow (DSC), mass change (TGA and combined TG/DSC), change of dimension (TMA), change of volume (DIL), thermal conductivity and thermal diffusivity (LFA), and the Seebeck coefficient/electric resistivity (LSR) of materials are studied as they change with temperature.

Scientex Pty Ltd
www.scientex.com.au

Monash opens cathodoluminescence characterisation facility

Professor Albert Polman officially opened Monash University's Advanced Cathodoluminescence Characterisation Facility on 4 February. Prof Polman, from FOM Institute AMOLF, is the inventor of angle-resolved cathodoluminescence and one of the pioneers of the field of nanophotonics — the control, understanding and application of light at the nanoscale.

Angle-resolved cathodoluminescence inventor Professor Albert Polman and DELMIC CEO Dr Sander den Hoedt open the Monash facility.

The facility was made possible through Australian Research Council (ARC) funding, which additionally enabled the university to commission a highly specialised analytical system from DELMIC. The device is based on a SPARC advanced cathodoluminescence system and provides Monash with a tool for researching important classes of new functional materials such as minerals, advanced pharmaceuticals and new electronic materials.

"We are already getting exciting results using the DELMIC SPARC cathodoluminescence system on solar cell materials, plasmonic nanoparticles and semiconductor nanowires," said MCEM Cathodoluminescence and Focused Ion Beam Manager Dr Amelia Liu.

As a standard system, the DELMIC SPARC performs angle-resolved and hyperspectral cathodoluminescence mapping allowing the imaging of optical modes and light emission at the nanoscale. This capability enables researchers to obtain new fundamental information about the physics of optically active nanoscale devices.

Monash University has customised the system, equipping it for fast, filtered and monochromated imaging modes with two additional photomultiplier tubes. The MCEM and DELMIC are working together to increase the capabilities of the instrument and software, and to multiply the number of applications of the system.

"The system provides vital information about a range of materials that we could not obtain any other way," said MCEM Director Professor Joanne Etheridge. "We have particularly enjoyed the collaboration with the expert team at DELMIC, which has enabled us to tailor this system to meet the specific and challenging needs of our research community."

The opening of the facility saw Monash University, in conjunction with DELMIC and DELMIC's Australian distributor, AXT, organise an advanced cathodoluminscence workshop and facility tour. Professor Polman delivered a keynote address, with other lectures given by CSIRO's Dr Colin Macrae and UTS's Professor Matthew Phillips, as well as DELMIC's Dr Toon Coenen, a co-developer of the SPARC system.

AXT Pty Ltd
www.axt.com.au

Human identity testing products

QIAGEN's Investigator kits, developed for forensic, human identity and paternity testing, rapidly generate DNA profiles from blood, buccal swabs and forensic stains. The company's sample and assay technology kits for human identity testing, and the associated manufacturing facilities, now meet the requirements of the ISO 18385:2016 standard.

The international standard specifies requirements for the manufacture of products used in the collection, storage and analysis of human DNA during forensic testing. These requirements seek to improve the quality of forensic testing around the world by minimising the risk of human DNA contamination during the manufacturing process. Manufacturers that comply with the requirements can label their products 'Forensic DNA Grade'.

Following the publication of the standard, QIAGEN announced the availability of ISO 18385:2016 Forensic DNA Grade products covering the entire workflow of sample and assays technologies, and both manual and automated methods. All of the associated manufacturing sites are operating under the standard.

The company's Investigator STR assay kits incorporate the Investigator Quality Sensor to evaluate the quality of DNA in each sample, a QIAGEN technology that enables labs to decide quickly which evidence may provide valuable results.

QIAGEN Pty Ltd
www.qiagen.com

Flow cytometer

ACEA Biosciences brings researchers high-performance flow cytometry with the NovoCyte benchtop platform. The user-friendly flow cytometer is said to remove the need for dedicated instrument managers.

High sensitivity and signal resolution are obtained by utilising innovative optical design and high-quality PMTs and lasers. Fluorescence signals are efficiently detected with a high signal-to-noise ratio, ensuring high-detection sensitivity for weak positive samples and small particles.

A full 7-log dynamic range and 24-bit signal detection ensures that all fluorescence intensities are captured on every sample and removes the need for complicated and laborious PMT voltage adjustments. Maintenance and cleaning of the system is simple. A simple click of a button initiates the automated cleaning and decontamination process and effectively removes any residual samples in the fluidics path, saving users valuable time from manual decontamination routines.

Intuitive acquisition and analysis software enables users to quickly analyse data during acquisition and automatically generate detailed reports. Compensations can be achieved by adjustment of the compensation scaling bar on the plot, eliminating tedious trial-and-error adjustments of compensation matrix coefficients.

In Vitro Technologies Pty Ltd
www.invitro.com.au

Optical tweezers and force spectrometer

The MMI (Molecular Machines & Industries) CellManipulator is a powerful optical multibeam optical tweezers system based on the mechanical forces arising from a strongly focused laser beam.

The product enables comfortable, precise and contact-free manipulation of microscopic particles, single or living cells, or subcellular organisms and the measurement of intracellular activities. It can hold, move, rotate, join, separate, stretch or otherwise manipulate up to 2 x 10 microscopic objects simultaneously or separately in three dimensions.

The wavelength of the laser does not interfere with the integrity of living specimens. Cell sorting and cell positioning can be accomplished together with the quadrant detector enabling the measurement of binding forces or viscosities at subcellular level. Due to multiple ports and dual-level laser integration, the seamless use of different modules and imaging technologies is possible.

Other features include: force detection of 0.2–800 pico Newton; good long-term stability; one or two tweezer levels for up to 2 x 10 traps; full control of laser power and focus; precise positioning of each single trap; high modularity for a wide range of applications; a compact laser box and controller; fully automated data acquisition and live data displays; and up-to-date laser safety concepts.

Automated quadrant detector calibrations routines allow routine force-distance measurements — so-called force spectroscopy. A feedback module is available for isometric force detections and force clamping.

SciTech Pty Ltd
www.scitech.com.au

Martin Wilkinson

Laboratory market transformation

drives systems innovation

The clinical laboratory market is in a period of rapid growth. Health expectations have risen globally in recent decades, with all member states of the World Health Organization committed to work towards the achievement of universal health coverage worldwide.

Pathology is involved in 70% of all diagnoses. The global market for clinical laboratory is expected to reach US$149 billion by 2020 if it follows the compound annual growth rate of 6.8% from 2014 to 2020, predicted in a new study by market analysts at Grand View Research.

Driving this growth, along with the rise of universal health care, is an ageing population and the increased prevalence of chronic diseases like obesity and diabetes. We are also seeing an upsurge of new testing methods — such as genetic testing and automated slide results scanning.

Key drivers transforming laboratories

Just as demand for laboratory services is rising, there is also pressure to meet this demand using fewer resources — to increase productivity while driving down costs.

Advances in automation, genomic testing and point-of-care testing are all driving disruptive changes in the laboratory market. Other drivers include healthcare industry consolidation, with increased economies of scale expected to deliver more test results at lower cost. Information will drive the life cycle of medical testing, as IT systems capture information at each stage of the healthcare continuum.

Today's laboratory information management systems do not meet the requirements of this new

environment. Instead, modern, agile information systems that enable the lab to capture, share, analyse and act on vast amounts of detailed data will be required to run a smart business. This is necessitating a new breed of system — what InterSystems calls a laboratory business management system (LBMS).

Transformation through information

Information is the core business for laboratories. It's their primary output. Lab professionals will need a laboratory business management system to meet their new challenges.

Patient data will be stored in secure data repositories, accessible via browser from any computing device with authorised access, including tablets, computers, mobile and wearable devices. For laboratories within a hospital group, all patient data will be unified within a shared electronic patient record, and lab workflow will be fully integrated with the care process.

Laboratory business management systems will employ software architectures that enable them to be deployed as a unified platform accessible within a single laboratory, across multiple sites or within a hospital or a group of hospitals. An LBMS will also interoperate with connected care systems and shared electronic health records throughout a region or country.

Extending laboratory information management capabilities across the healthcare enterprise will enable transformational change in clinical laboratories.

For example, the 'hub and spoke' model being implemented in the UK following the Carter Report specifies that high-volume testing be done closer to patient locations, while specialised testing is performed off-site in laboratories that service a number of healthcare organisations. This model also ensures maximum return from expensive specialist equipment.

Models like this require a flexible laboratory business management system that enables information and workflows to be shared and integrated across multiple locations.

Labs to become data-driven businesses

With an LBMS, laboratories will be able to implement their workflow protocols (or standard operating procedures) and cost every procedure. Clinical directors and business managers will run a fine-tuned, data-driven business, with LBMS giving them the visibility, control and accountability over business processes now seen in the best enterprise resource planning software.

Laboratory throughput and turnaround times will be constantly monitored. Software will pinpoint workflow bottlenecks without the need for custom analytics. Each laboratory or group will be able to easily configure relevant key performance indicators and/or service-level agreements and monitor them through dashboards and alerts.

Pathology is a traditionally unpredictable supply-and-demand service. When laboratory systems can capture and access relevant information along every step of the testing process, they will also deliver unprecedented ability to predict and manage variable workloads.

For example, at the same time a doctor completes a pathology test order, before the sample has even been taken from the patient, the data will feed into the LBMS, improving the predictability of workload hours before they need to be resourced.

Faster results and second opinions

When you bring connectivity into the model, you don't need to wait for the postman. Electronic transfer of results is not only faster; it's also more secure. The progress of testing can be tracked from patient to laboratory to clinician.

Reporting will be much faster, with results delivered instantly to care teams, with the single shared data repository automatically directing results to the patient record. Customers — clinicians, hospitals, family practitioners — will have instant access to results via their internet browsers using the latest mobile devices, subject to appropriate security protocols.

The growth of digital pathology and telepathology will also allow digital samples to be instantaneously transferred for a second opinion. LBMS will support second opinions and referrals of digital pathology results rather than making physical transfers of specimens (reducing both the cost and the potential for error.)

Putting patients at the centre of care

The LBMS will support connected care models that put patients at the centre of healthcare delivery with support for a contiguous pathology patient record (PPR). This will be part of the electronic patient record if the laboratory is part of a healthcare group, and integrated with regional or national shared electronic health records. The PPR would include all test data relevant to patients, even point-of-care testing results.

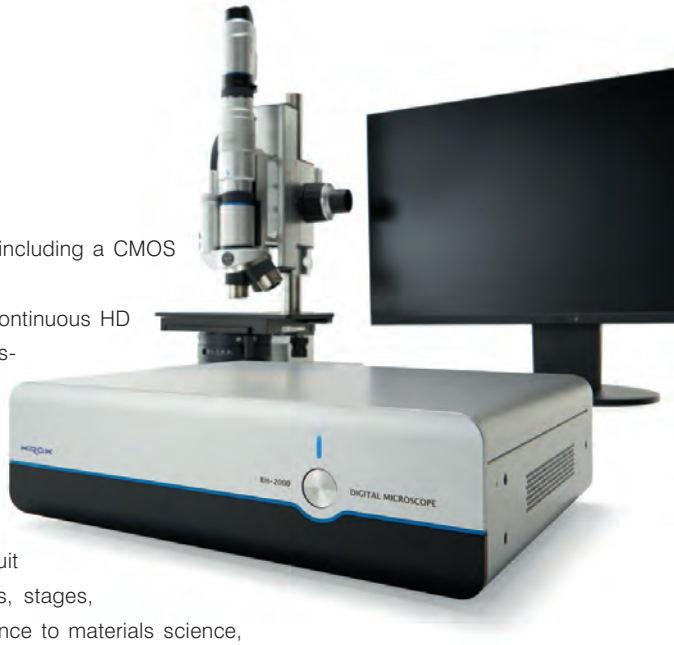
The LBMS will also support connected care functionality such as electronic gatekeeping. Clinical directors will be able to institute pre-approval processes for costly tests so they first satisfy funding rules, for example. At the same time, system workflows can ensure these orders are automatically submitted for approval to multiple connected parties and that they are instantly released when approved — speeding up the process and eliminating paperwork chase within laboratories.

In conclusion, the fast-changing laboratory market is ripe for a new generation of information systems that meet the needs of a modern pathology environment. While the pressure to deliver more test results at lower cost will only intensify, advanced information technology will make laboratory professionals the drivers of change, rather than the victims of disruption.

Martin Wilkinson is the Sydney-based Laboratory Product Manager for InterSystems and global head of the company's solutions for the laboratory market. He is also a Fellow of the Institute of Biomedical Science (IBMS).

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

3D digital microscope



Hirox has released the RH-2000 digital microscope, which has a host of features including a CMOS camera, a refined hardware design and a touchscreen interface.

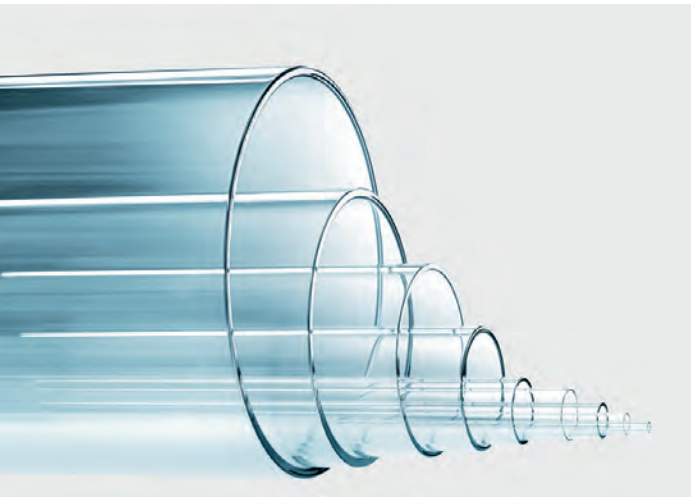
At the heart of the product is a CMOS sensor capable of capturing 50 fps of continuous HD video at 1920 x 1200 pixels, with high pixel density. The latter allows for precise measurement performance with a wide dynamic range and increased signal-to-noise ratios, regardless of increasing contract levels. Redesigned hardware integrates communication connectors into optical componentry, eliminating the need for cables and resulting in simplified set-up and lens exchange.

The microscope connects to the user's choice of PC via high-speed USB 3.0, with transmission rates of up to 5 Gbps. This allows users to specify a PC to suit their requirements. The device can also be equipped with a vast array of lenses, stages, filters and other accessories to suit the user's particular application, from life science to materials science, electronics or even forensics.

The product's Auto Count/Binarisation capability for particle size and counting extends the microscope's suitability into fields such as petrography. Other characteristics include all-in-focus imaging, producing focused images regardless of height; real-time measurement for length, angle and surface area; and report writing that can export results to Microsoft Office applications.

The digital microscope enables the easy generation of 3D models using image stacking. Fully integrated hardware and software enable the user to generate large-area 3D images using automated tiling and stacking. Detailed analyses of profiles, surface areas, volumes and roughness are easily generated using sophisticated yet user-friendly software tools.

AXT Pty Ltd
www.axt.com.au

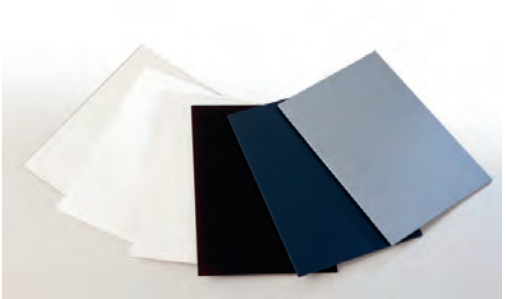


Glass-ceramic range and technical glass tubing

SCHOTT has released the NEXTREMA glass-ceramic family for use in high-temperature applications, as well as tubing, rods and capillaries for various technical applications. Both product groups offer product developers special functionality and innovative design options.

NEXTREMA combines the advantages of technical glass (high transmission, resistance, non-porous surfaces and the production of large plate formats) with good thermal properties. Thermal resistance up to 950°C and endurance of thermal shocks of up to 800°C are possible.

The glass-ceramic is available in six different versions, which differ not only in terms of their colour impression but also their technical characteristics. They come in a wide variety of material thickness ranging from 2 to 8 mm. They enable engineers and designers alike to develop and realise product ideas such as infrared applications, high-temperature furnaces or grills.



The company also has a range of tubing, rods and capillaries with different wall thicknesses and inner diameters for use in technical applications. They can be made from 60 different types of glass and can be enhanced by applying special coatings. The company's oval glass tubes, made of CONTURAX borosilicate glass, are said to accelerate the growth of algae significantly.

In addition, DURAN glass tubing allows for 360° camera technology to be used for online streaming. Panoramic videos can be transmitted in real time. The camera technology is used for television science programs and at concerts, sporting events and trade shows.

Schott Australia Pty Ltd
www.schott.com/australia/english/index.html

Soil measurement probe

Sentek Technologies' latest range of sensing solutions records soil water and salinity data at multiple depths in the soil profile through the use of capacitance technology and then uses the internet and satellites to transmit the data in real time from almost anywhere in the world.

The company's Drill & Drop Probe can reduce sensor installation time from 40 down to 5 min, avoiding the need to dig large holes to bury technology underground. The user simply drills a hole and pushes the probe in. This allows the user to access the data collected by this probe from anywhere in the world in real time.

In addition to the probe, Sentek also supplies software that enables the user to look at the data and use it to make informed decisions. Even users who have no internet coverage can access real-time data via satellites.

Sentek Pty Ltd
www.sentek.com.au

UV assay microplates

Krystal UV quartz-bottomed microplates from Porvair Sciences are designed for high-throughput applications which require excitation or detection wavelengths in the far UV region below 350 nm.

Made from polished fused quartz, the UV plates are suitable for cell-based assays requiring monitoring in the UV region down to 200 nm. Direct quantitation of DNA/protein rations at 260, 280 and 240 nm is possible through use of the plates. Designed to exhibit low auto fluorescence, they are available in 96- and 384-well plate designs, both compliant with ANSI/SLAS standards.

Precision engineered and assembled using biocompatible adhesive technology, the plates can be used for sensitive UV and fluorescence assays. Their high degree of planar flatness makes them suitable for use with automated plate reading, confocal microscopy and liquid handling systems.

BMG LabTech Pty Ltd
www.bmglabtech.com

Reagents for optimised western blotting

GeneTex has released its Trident Series of products for optimised western blotting. Beginning with a focused selection of cell extraction kits that allow rapid collection of total protein or nuclear, cytoplasmic or membrane protein fractions from cells or tissues, the series also includes buffers and blocking solutions.

One product from the series is the Trident Prestained Protein Ladder (GTX50875). The protein standard consists of 12 prestained markers from 10–245 kD. The protein markers are bound to a blue chromophore for clear visualisation, with the exception of the 25 and 75 kD markers, which are green and red, respectively, for ease of orientation. The ladder's broad distribution of molecular weight standards means that it can be used for the analysis of almost any target protein.

In conjunction with GeneTex's high-quality antibodies, the series will help improve the consistency of the western blotting process from cell extraction to the final signal on film or imager.

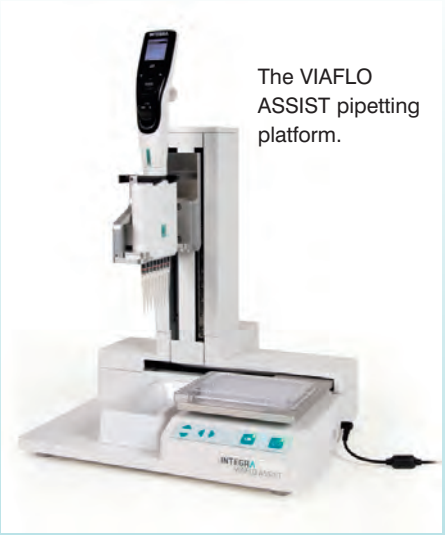
Sapphire Bioscience
www.sapphirebioscience.com

Scaling up screening

Researchers at the Health Innovations Research Institute (HIRi) at RMIT University are using VIAFLO II electronic pipettes from INTEGRA Biosciences, in conjunction with a VIAFLO ASSIST pipetting platform, to scale up their screening of venoms and small compounds.

The HIRi is an RMIT initiative that seeks to address key health issues facing Australia in the 21st century, with research programs that examine how the human body functions at a molecular and cellular level. This research is targeted to provide innovative therapeutic strategies to improve the health and wellbeing of people in Australia and around the world.

"We approached INTEGRA's Australian distributor (BioTools) for a solution to scale up our screening of venoms and small compounds in both 96- and 384-well plates," said HIRi researcher Bill Darby. "Following a demonstration, we found that the VIAFLO ASSIST pipetting assistant met our required criteria of a cost-effective and easy-to-use pipetting solution, which led us to purchase the ASSIST and 3 VIAFLO II multichannel pipettes.



The VIAFLO ASSIST pipetting platform.

"Since its introduction, the system has been running perfectly and we have been able to achieve the scaling up we required. The ASSIST has delivered more accurate and precise pipetting results that have improved our assay results. Another significant benefit is that the ASSIST is very compact and easily fits in our lab hood. We have also found that the versatility of the VIAFLO II pipettes has proven especially useful for handling complicated layouts in 384-well plates."

BioTools Pty Ltd
www.biotools.com.au

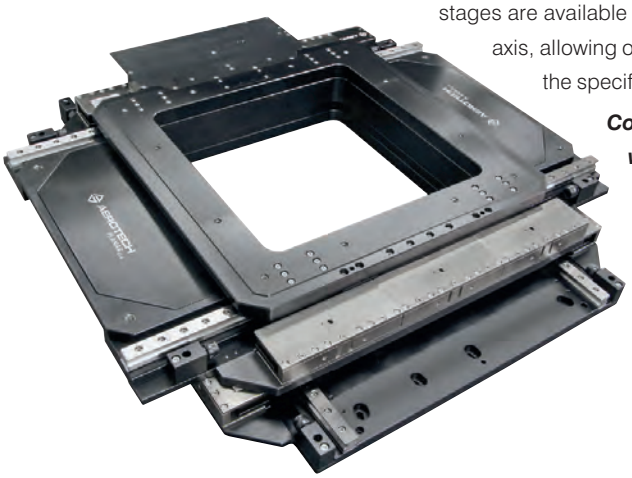
Linear motor stages

Aerotech has introduced a series of integrated open-frame stages with precise geometric performance and micrometre-level straightness. There are nine models in the series to accommodate user requirements for travel and accuracy.

The PlanarDLA stages include high-precision roller bearings, precision-machined surfaces and non-contact linear motors that drive through the axes' centre of stiffness. These features result in straightness to ±0.5 μm and flatness to ±1.25 μm.

The product enables high-throughput processing with 2 m/s velocities and 2 g accelerations, resulting in good process yield and a low total cost of ownership. It achieves high servo bandwidths while maximising the clear aperture available and keeping the overall height to a minimum. Aerotech's direct-drive technology offers high speed and accurate positioning, coupled with maintenance-free operation and long service life.

The low-profile stages are designed for a wide range of applications, including semiconductor manufacturing; electronics manufacturing (LEDs); test and inspection; laser processing; metals inspection; micromachining; nanotechnology; medical; laboratory; optical metrology; wafer processing; metrology; and automation. The stages are available with one or two motors per axis, allowing optimisation of each axis for the specific application and process.



Coherent Scientific Pty Ltd
www.coherent.com.au

Hydrogen generator

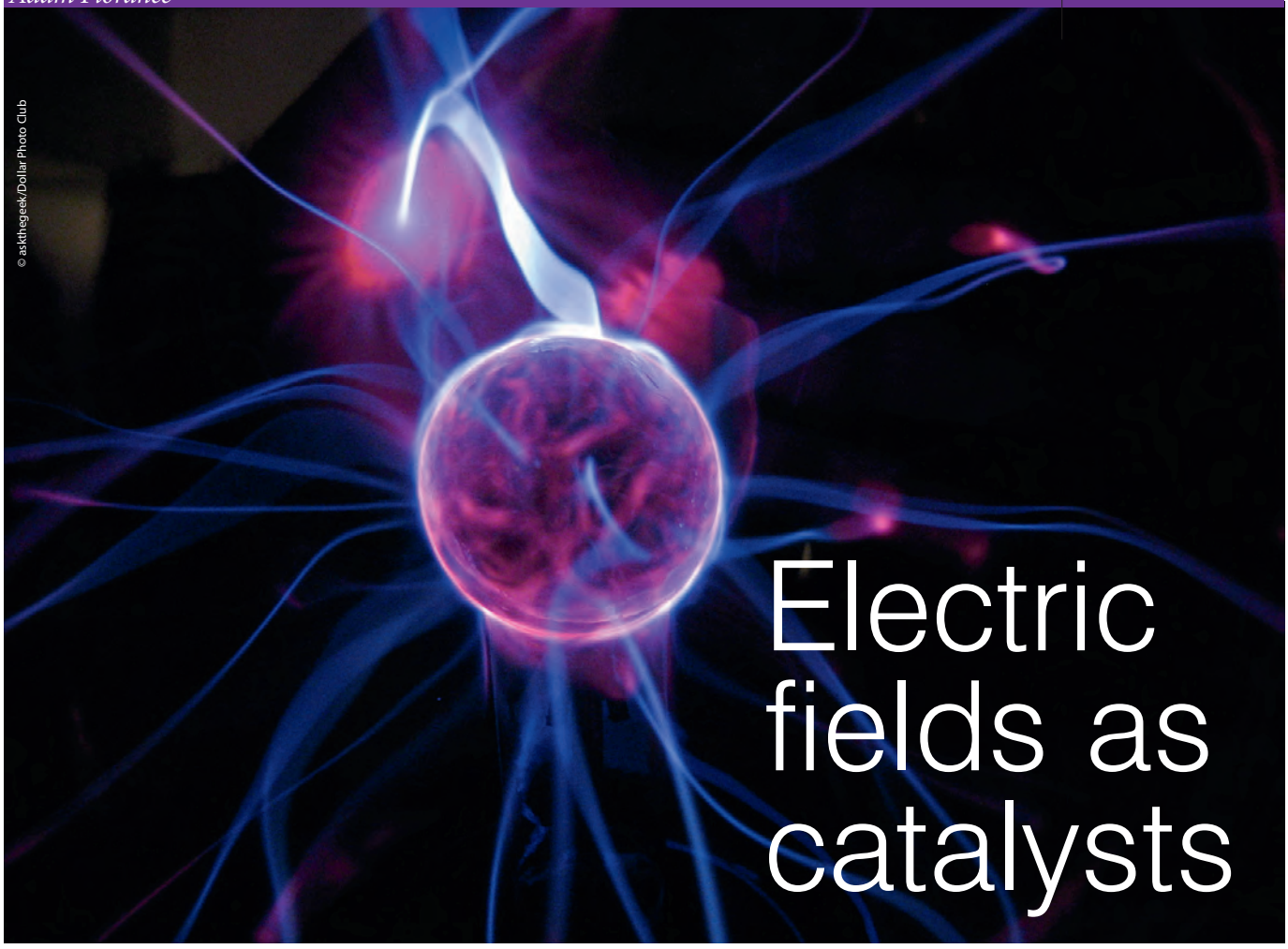
Peak Scientific has extended its range of hydrogen generators for laboratories with the launch of the Precision Hydrogen Trace 250. Engineered to the same exacting standards as the existing Precision range, it is suitable for those requiring lower flow rates, such as labs with only one or two GC instruments. It features innovations in trace dryer technology that ensure ultrahigh purity performance.

For those currently using hydrogen or considering hydrogen as a carrier gas for GC and GC-MS, the generator delivers 250 cc/min of hydrogen at 99.99% purity. Incorporating the same compact, modular form factor as all Precision units allows users to build a Precision stack to meet their specific application's gas requirements while taking up minimal laboratory floorspace.

Peace of mind and ease of use are at the heart of the generator's design, with no maintenance required; comprehensive, rapid-response, on-site warranty; and an automatic water loading pump and cascading capability provided as standard. The product offers a safe, hassle-free supply of carrier-grade hydrogen that is said to improve laboratory productivity and performance.

Peak Scientific Instruments Pty Ltd
www.peakscientific.com

Adam Florance



Electric fields as catalysts

An Australian-led team of scientists has harnessed static electricity, using an electron microscope as a kind of remote control, to increase the efficiency of the Diels-Alder reaction. This development could have significant impacts on nanotechnology and cleaning up a wide range of industrial applications.

The team managed to harness the static electricity generated by the tip of a scanning-tunnelling electron microscope and use this electric field as the catalyst for the Diels-Alder reaction, in which a conjugated diene and a substituted diene form a cyclohexene system.

Catalysts for such reactions typically involve rare and expensive chemicals which can contaminate the end products and leave polluting by-products.

Electric fields can be controlled from outside the test tube at very high speeds, effectively giving scientists a remote control over complex chemical reactions. The electric field catalyst has the potential to improve the production efficiencies of a wide range of chemicals, including the drug cortisone and a variety of self-healing materials.

The team was brought together under the direction of the ARC Centre of Excellence for Electromaterials Science (ACES). Lead researcher Professor Michelle Coote said, "It's the most unexpected result possible... we now have a totally new way of thinking about chemistry."

Professor Coote, who is based at the ANU Research School of Chemistry, had theorised that electric fields could strongly affect reaction rates but this idea had never before been tested. ACES brought together Professor Coote, Dr Simone Ciampi from the University of Wollongong and a team of researchers from Spain's Universitat de Barcelona in order to devise a way to test Professor Coote's prediction.

Normally the molecules involved in a standard chemical reaction are randomly oriented within a liquid or gas, making observation of the reaction extremely difficult. The ACES team attached the molecules to a surface, allowing for precise orientation before testing each molecule with the probe of an electron microscope. They were able to vary the rate of the Diels-Alder reaction by a factor of five through careful manipulation of the strength and polarity of the electric field.

Professor Coote believes this breakthrough could have significant impacts in a wide variety of manufacturing processes through an unprecedented level of control over chemical reactions, "for example, in manufacturing flexible electronic components based on organic circuits".

This research was made possible by the collegial environment and multidisciplinary approach fostered by ACES. Professor Gordon Wallace, the ACES director who brought the team together, said this holistic approach to interdisciplinary research makes it possible to mobilise the diverse skill sets required to take ideas to industries as rapidly as possible.

Published in the latest edition of *Nature*, Professor Coote hopes that this research can lead to greater understanding of the ways in which natural biochemical reactions use enzymes as catalysts.

Professor Michelle Coote. Image credit: Stuart Hay, ANU.

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