

# Lab+Life SCIENTIST



Obscure research can be  
the goose that lays the  
**golden egg**

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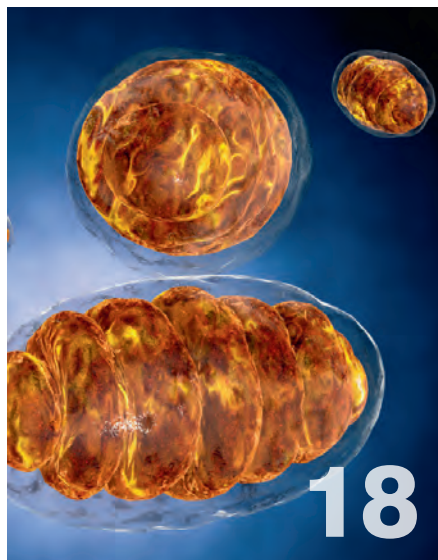
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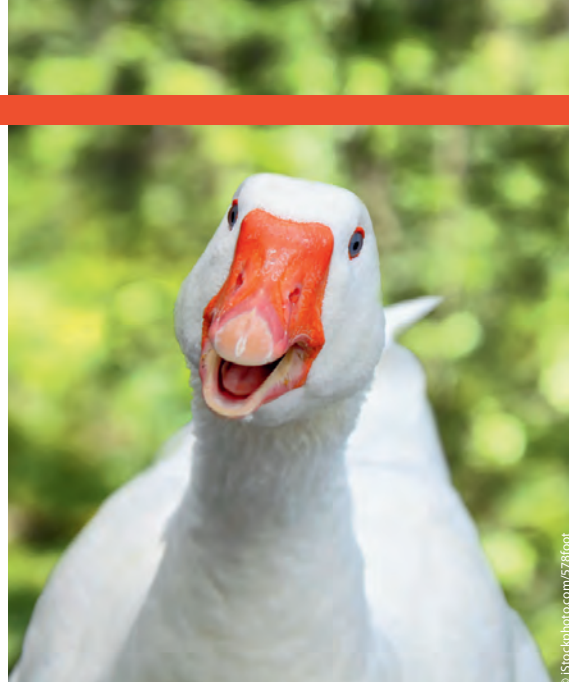
# Golden Goose Award

## goes to 'sex life of the screwworm' researchers

US researchers Edward F Knippling and Raymond C Bushland, who were ridiculed for their study of the sex life of the screwworm fly during the mid-20th century, will be posthumously honoured later this year with a Golden Goose Award.



The secondary screwworm fly (*Cochliomyia macellaria*) lays its eggs in carrion or sometimes open wounds; the worm-like maggots emerge and eventually become adult flies like this one. Unlike the 'primary' screwworm (*Cochliomyia hominivorax*), the maggots are not known to invade healthy tissue. Image courtesy of K Schneider (via Flickr) under CC BY-NC 2.0



**T**he Golden Goose Award, created in 2012, honours scientists whose federally funded work may have been considered silly, odd or obscure when first conducted but has resulted in significant benefits to society. Knippling and Bushland are being cited for research that led to the 'sterile insect technique', in which lab-raised and sterilised male insects are used to overwhelm and eventually eradicate native pest populations.

Though most Americans today are not familiar with the screwworm fly, prior to the 1960s, ranchers in the southern US were locked in a constant struggle against the deadly insect. Female screwworms lay their eggs in the wounds of cattle, livestock and even humans. The eggs hatch into maggots that feed on wounded flesh; these maggots can kill a full size cow in less than two weeks. The pests cost ranchers hundreds of millions of dollars each year in lost livestock.

Working at field stations in Texas and Florida in the early 1930s to 1950s, Knippling, Bushland and their colleagues suggested the use of sterilised males to overwhelm wild screwworm flies and cause the population to collapse through natural mating behaviour — an approach that was met with scepticism from peers. The researchers went on to demonstrate that they could inflict mass sterilisation of insects through irradiation — a feat widely lauded as one of the most important developments in pest control and one of the first peaceful uses of nuclear radiation.

In 1953, after an unexpected request from a Dutch official on the island of Curacao, the researchers completed the first full-scale field test of the technique on the island. After just three months, not a single sterile egg could be found on the island. The technique worked even better than predicted.

The US Department of Agriculture (USDA), with support from state governments and local communities, launched a larger scale effort to eradicate the screwworm fly throughout the southern US. By 1982, the fly had been eradicated across the country. Since then, the USDA has partnered with countries throughout Central America to wipe out the flies to Panama, where today it maintains a border zone to prevent reinfestation from South America.

The eradication effort has saved US meat and dairy suppliers billions of dollars over the past 50-plus years and has also given US consumers an estimated 5% reduction in the price of supermarket beef. In the developing world, meanwhile, the pest control technique is a crucial component of food security and public health.

The technique continues to inform ongoing fights against other agricultural pests and insects carrying infectious pathogens, including the tsetse fly and the *Aedes aegypti* mosquito — the primary culprit in transmission of the Zika virus. It also serves as an inspiration for cutting-edge research on gene drives.

"Given the recent rise of infectious diseases like the Zika virus, developing eradication programs for carrier pests is a much-needed field of scientific research," said US Representative Randy Hultgren. "Even though 'worms' might make some members of Congress — as well as the public — a little squeamish or sceptical of the research we invest in, these studies by Drs Edward F Knippling and Raymond C Bushland have clearly paid off."

The entomological researchers will be honoured along with two other teams at the fifth annual Golden Goose Award Ceremony at the US Library of Congress on 22 September. For more information about the award, visit <http://www.goldengooseaward.org/>.



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It turns out that the hunt for gravitational waves could transform the way we carry out bone grafting.

W

hat if you could grow a bone in the lab using the power of vibration? It sounds fantastic, but researchers from the University of the West of Scotland (UWS) and the University of Glasgow (UoG) have collaborated on a method which could do exactly that.

Bone is the second most commonly transplanted tissue in the world. Unfortunately, bone grafting surgery is a rather painful and complicated procedure which sees bone samples removed from other parts of a patient's body before being encouraged to grow or fuse with other bones — usually through the use of bone-forming chemicals or growth factors. Potential complications include the risk of rejection and even tumours.

Back in 2010, stem cell engineers at the University of Glasgow were interested in the effect vibrations had on multipotent stem cells — that is, cells which can grow into many types of tissue needed throughout the body such as fat, cartilage and bone. They realised that physical stimulation might trigger bone growth, as bones are very responsive to pressure — indeed, it is the stress placed on them from movement, called 'bone loading', that keeps bones repairing themselves.

It turns out that shaking stem cells by billionths of a metre — or nanometres — flicks on switches which turn these cells into bone-producing cells, triggering the transformation that happens naturally as the bones in our body grow and heal throughout our lifetime. As noted by UWS researcher Professor Stuart Reid, "The scale of movement that triggers the cells to transform is so small it would be the same as sliding a single sheet of paper in and out from under a football on a table."

To measure movements this small, the team used the same laser technology as in the hunt for gravitational waves, albeit scaled down. UoG Professor Matt Dalby explained, "A colleague of mine... started collaborating with gravity wave physicists [at UWS], who developed all these techniques for making very small measurements as they wanted to detect gravity waves, which are incredibly small — much more than our 'nanokicks'."



# What do gravitational waves and bone grafting have in common?





It turns out that shaking stem cells by billionths of a metre — or nanometres — flicks on switches which turn these cells into bone-producing cells

Christina Boyle, a PhD student at UWS, explained that her group developed nanokick bioreactors to perform different types of experiments on different types of cells, controlling factors such as “the height of the nanovibration, the amplitude, the number of times we shake the cells per second, the frequency and the overall duration of stimulation”.

“After the stimulation period, we take the cells for analysis to see how they reacted to the nanokicking,” Boyle continued. “We can then further analyse these by looking at the cells down a microscope to see how their shape has changed, or even look even deeper into their genes to see which ones have been switched on or switched off.”

Professor Dalby said it seemed like “a mad, eccentric idea... but as we vibrate the stem cells, we tell them to turn into bone cells, and we can envisage clinical use for that in bone augmentation processes”.

“It’s amazing that technology developed to look for gravitational waves has a down-to-earth application in revolutionising bone treatments for cleaner, safer and more effective therapy,” he said.

So exactly how would these cells be implemented in bone grafting surgery? Professor Reid explained that the technique could allow scientists to grow new pieces of bone from a patient’s own stem cells, either from their bone marrow or even from fat cells from liposuction. The nanokicked bone could then be implanted where needed to fuse with existing bone and heal bone damage or fractures.

“By using a frame, we can design bespoke grafts replicating the area of need in the patient,” Professor Reid said.

“And by using stem cells harvested from each patient, this process would reduce the risk of rejection. This could mean the end of the painful practice of taking grafts from the patient’s own hip, for example, revolutionising patient care.”

Nanokicking could also have an important role in drug discovery and has shown promise in other areas of research, such as osteoporosis. Early results suggest that the technology could be used to identify therapeutics which slow down fast-growing bone cancers.

“Perhaps best of all, though, this could help us develop new treatments and drugs for bone disease, something which has proved very difficult to combat in the past,” said Professor Reid.

The nanokicking research is funded by the Engineering and Physical Sciences Research Council (EPSRC) and Biotechnology and Biological Sciences Research Council (BBSRC). The funding has enabled the research team to scale up the bioreactor, to make bioreactor dedicated consumables and to improve the quality of the bone graft produced.

With the research still at the validation stage, said Professor Dalby, the researchers’ next step is to understand how their living bone graft compares to synthetic, non-living alternatives, before making their way through the regulatory process. The team aim to test the bone in people within 3–5 years, with the potential for therapy to be available in 10 years.

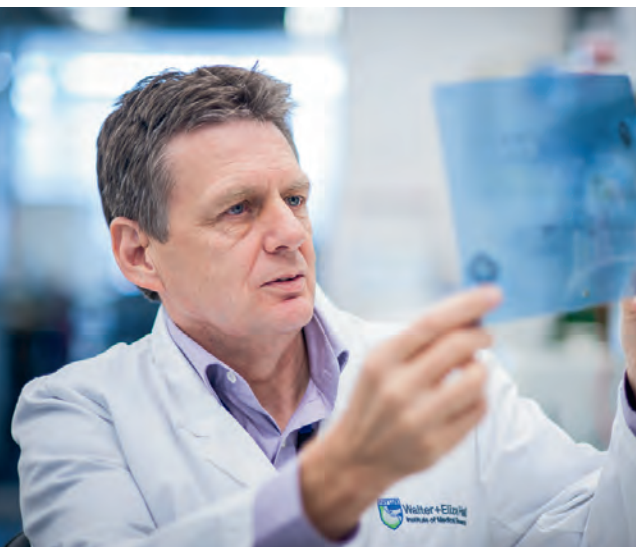
Further down the line, the researchers may even be possible to nanokick patients directly to heal fractures without surgery. They are also commercialising the bioreactor they have designed to make it available to other scientists and bone researchers.

“We hope that this research can lead to an off-the-shelf solution to demand for living bone graft,” said Professor Dalby. “This demand might be within the NHS to deal with both elective and trauma surgeries, but could also be worldwide to supply high-quality bone graft to hard-to-reach places.

“Further, we are developing acoustic nanokicking and, while this is in very early-stage development, we hope this will be used to apply nanokicking directly to patients to help bone healing.

“Nanokicking offers tremendous potential and we have only just scratched the surface on what this process enables us to do.”

The technology was featured at this year’s Royal Society Summer Science Exhibition as one of 22 exhibits, selected via a competitive process, of cutting-edge science and research being done right now across the UK. The research was also published in the July 2016 edition of the *Journal of Biomedical Nanotechnology*.



Professor Alan Cowman, Walter and Eliza Hall Institute of Medical Research.

## Preventing malaria by removing proteins

Researchers from the Walter and Eliza Hall Institute (WEHI) have shown that the malaria parasite cannot penetrate a human red blood cell when key proteins are deleted.

Their study, published in the journal *Cell Host & Microbe*, gives fresh hope to the development of much-needed new antimalarial treatment, with existing drugs becoming less effective as the parasite develops resistance.

Professor Alan Cowman and his team at WEHI discovered that three proteins known as Rh5, Ripr and CyRPA together form a complex that plays a vital role in the ability of the *Plasmodium falciparum* parasite to invade healthy human blood cells. In a study that effectively removed or 'knocked out' the Ripr or CyRPA proteins, the malaria parasite was unable to invade the red blood cell, stopping infection.

"These findings hold great promise for understanding the function of these proteins and their development as vaccines," said Professor Cowman, adding that the development of new vaccines for malaria is a global research priority.

## Mineral processing with molten salts

The University of South Australia (UniSA), the South Australian and Western Australian governments and Centrex Metals are funding technology that will significantly reduce the cost of mineral processing using molten salts. The research, based around Centrex's Oxley Potassium Project (Oxley), will expand current molten salt research for solar energy applications into minerals processing.

The project will be the basis of research targeting potassium from potassium feldspar, an alkali metal silicate mineral ( $\text{KAlSi}_3\text{O}_8$ ). Centrex has already developed a process route for its Oxley potassium deposit that is a mix of molten salt processing for conversion of potassium to a leachable form, followed by extraction and purification in a low-temperature aqueous circuit. The process route is focused on the production of high-value specialty fertilisers such as potassium nitrate or potassium sulfate.

Undertaken at UniSA's School of Engineering and Future Industries Institute, the program will develop a minerals processing circuit to leach, extract and purify metals from silicate minerals in a solely molten salt environment, without the need for subsequent aqueous processing. If the research provides the ability for all processing steps to be undertaken in a molten salt environment, it will lower energy and water use and the associated costs, allowing consideration of and expansion of the project into lower-value bulk potassium chloride fertiliser to be manufactured by Centrex.

The research is proposed in three stages over approximately three years. Stage 1 will provide proof of concept for the behaviour of ore to be processed in a molten salt environment; Stage 2 will seek to design, build and test the required processing equipment components for the molten salt circuit; and Stage 3 will seek to construct a continuous pilot plant to demonstrate the technology. \$464,000 of external funding has already been committed for the first two stages of research.

UniSA Associate Research Professor Frank Bruno, who is leading the project, said the challenges to providing proof of concept for the molten salt separation technology include mechanical and materials engineering issues involved with transferring and separating solids from highly reactive molten salts at high temperatures.

"Currently, molten salts are being used commercially in the solar and nuclear industries at temperatures up to 600°C and while molten salts are used commercially at higher temperatures for batch style minerals roasting processes, this project will develop novel technology for reaction, separation and purification processes in molten salts above 850°C," Associate Professor Bruno said.

"The knowledge developed in relation to the mechanical and materials engineering issues involved with transferring and separating solids from highly reactive molten salts at high temperatures can be adopted in other applications such as solar power plants, high-temperature thermal energy storage, molten salt reactors, glass optical property modification and refining for other minerals."

Contracts for the program are now being prepared and the research is due to commence in the second half of the year.



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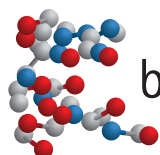
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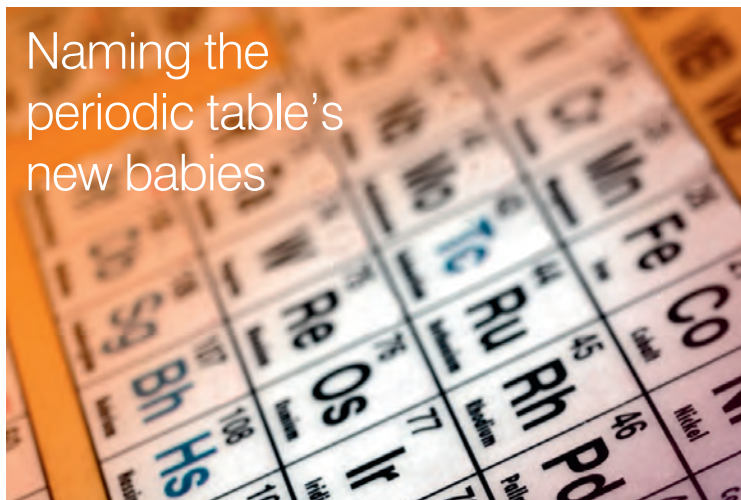
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## Naming the periodic table's new babies



The researchers who discovered four new elements of the periodic table last year have submitted their proposed names to the International Union of Pure and Applied Chemistry (IUPAC). The IUPAC Inorganic Chemistry Division has reviewed and considered these proposals and recommends these for acceptance.

For the element with atomic number 113, the discoverers at Japan's RIKEN Nishina Center for Accelerator-Based Science proposed the name nihonium and the symbol Nh. Nihon is one of the two ways to say 'Japan' in Japanese and means 'the Land of Rising Sun'. The name is proposed to make a direct connection to the nation where the element was discovered.

For the element with atomic number 115 the name proposed is moscovium, with the symbol Mc. For the element with atomic number 117, the name proposed is tennessine with the symbol Ts. These were proposed jointly by the discoverers at Russia's Joint Institute for Nuclear Research and the US-based Oak Ridge National Laboratory, Vanderbilt University and Lawrence Livermore National Laboratory.

Moscovium is in recognition of the Moscow region, honouring the home of the Joint Institute for Nuclear Research, where the discovery took place using the Dubna Gas-Filled Recoil Separator in combination with the heavy ion accelerator capabilities of the Flerov Laboratory of Nuclear Reactions. Tennessine is in recognition of the contribution of the Tennessee region, including Oak Ridge National Laboratory, Vanderbilt University and the University of Tennessee, Knoxville, to superheavy element research.

For the element with atomic number 118, the teams at the Joint Institute for Nuclear Research and Lawrence Livermore National Laboratory proposed the name oganesson and symbol Og. The proposal recognises Professor Yuri Oganessian for his pioneering contributions to transactinoid elements research. His many achievements include the discovery of superheavy elements and significant advances in the nuclear physics of superheavy nuclei, including experimental evidence for the 'island of stability'.

"Although these choices may perhaps be viewed by some as slightly self-indulgent, the names are completely in accordance with IUPAC rules," said Jan Reedijk, who invited the discoverers to make proposals. "In fact, I see it as thrilling to recognise that international collaborations were at the core of these discoveries and that these new names also make the discoveries somewhat tangible."

A five-month public review will now take place, expiring on 8 November, prior to the formal approval by the IUPAC Council. After the lapse of the review, the final recommendations will be published in the IUPAC journal *Pure and Applied Chemistry*. The Provisional Recommendation regarding the naming of the four new elements can be found at <http://iupac.org/recommendations/under-review-by-the-public/>.

## Tropical disease detection funded by the government

Medical device manufacturer Atomo Diagnostics has secured \$1.38 million in grant funding from the Australian Government to assist in the development and commercialisation of new rapid tests for the detection of dengue and chikungunya viruses, which are leading causes of illness and death in the tropics and subtropics.

According to Atomo Group CEO John Kelly, the government funding will help "deliver a much-needed, easy-to-use solution for the rapid diagnosis of diseases which impact hundreds of millions of people". This is because the viruses are readily transmitted by mosquitoes and there are no vaccines to prevent infection, so early detection and treatment is critical to limit the risk of complications and death.

Atomo's all-in-one integrated rapid diagnostic tests (RDTs) are recognised internationally for their usability and performance. Its AtomoRapid platform is highly versatile and can accommodate any blood-based assay requiring <50 µL blood. The blood collection unit rotates safely to deliver a controlled blood volume to the correct location on the test strip, and the lancet automatically retracts into the device after lancing.

The funding will enable the company to adapt its current AtomoRapid technology to integrate two test strips into a single device, allowing both antibodies and antigen levels to be detected at the same time from a single blood sample. The all-in-one test will improve on current-generation test kits, which currently require the use of many accessories and have challenges with complexity, high error rates and misdiagnosis.

Atomo will work with a number of Queensland-based academic partners to commercialise the tests.





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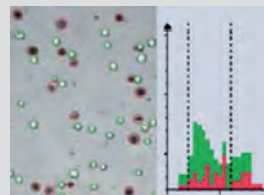
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## Could cannabis treat skin cancer?

The University of Canberra (UC) and Cann Pharmaceutical are teaming up on a million-dollar, medical-grade cannabis therapy trial for melanoma patients.

The two-year research project aims to produce a novel combination therapy treatment program for Australians living with melanoma. The identified strains of cannabis at the centre of the research have been developed by Cann Pharmaceutical and will be coupled with the current standard care for melanoma patients.

The research will be led by UC Professor Sudha Rao, who believes the project will help better inform the efficacy of medical cannabis-based treatments for melanoma. She noted, "When you consider that melanoma is the third most common cancer in Australia and New Zealand, and almost 1800 people will die as a result of this cancer this year, we need to work harder at finding effective treatments."

UC Acting Vice-Chancellor Professor Frances Shannon said the university is "incredibly excited to take a leading research role into the application of medicinal cannabis for Australian patients".

"The support of Cann Pharmaceutical Australia, providing access to their medical-grade cannabis strains and funding worth \$1 million, is critical to taking this work from laboratory testing to clinical trials," she added.

The project is expected to commence the initial clinical trial phase in 2017.

## CSL and QIMR Berghofer partner on translational research

Global biotherapeutics company CSL has announced a five-year agreement with QIMR Berghofer Medical Research Institute to help turn the institute's scientific discoveries into innovative new medical technologies.

Working in close collaboration with clinicians at neighbouring hospitals in the Herston precinct and other research institutes in Brisbane, QIMR has a rich history of scientific discoveries and translational medical research. According to QIMR Berghofer's director and CEO, Professor Frank Gannon, the goal of the new agreement is to move this research towards commercialisation faster.

"CSL's input and expert advice will support the translation of QIMR Berghofer's research and will help to ensure these projects answer the critical commercial questions, accelerating their path towards commercialisation," Professor Gannon said. QIMR Berghofer will maintain the rights to any subsequent intellectual property.

"At QIMR Berghofer, our priority is to take our research from the laboratory bench, to the biotech lab, to the hospital bedside so it can benefit the community. We call that our B2B2B plan. This financial assistance and commercial input from CSL will help us to do that.

"In doing so, it will also support jobs and investment in Queensland and Australia."

CSL's chief scientific officer, Dr Andrew Cuthbertson, said the partnership with QIMR is "one of a number of new initiatives ... designed to support the brightest minds in biomedical research and continue our support of Australian medical discovery".

At the same time, the move is one of several strategies QIMR Berghofer has adopted to help translate more of its scientific research into new treatments and diagnostics. For example, the institute will give researchers the opportunity to take a leave of absence for up to two years to work in the biotechnology sector.

"This initiative will allow our researchers to get experience in the commercial sector and follow their innovations through to the commercial stage, then return to the institute with significant new skills," Professor Gannon said.

QIMR Berghofer has also established a new initiative known as The SEEDBox (Scientific Exploitation and Entrepreneurial Development), which will provide investment and expertise to prepare qualified projects for commercialisation. The SEEDBox will be run by managers with industry experience and will be supported by international advisors, including CEOs and entrepreneurs.

"These expert advisors will help our scientists to get their research ready to start attracting investment," Professor Gannon said.





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The camera possesses fast frame rates and high sensitivity for a 512 x 512 EMCCD camera, enabling researchers to obtain high-quality super-resolution images in half the time it takes other 512 x 512 EMCCD cameras on the market, according to the company. The camera now comes with LightSpeed for high-speed ROI acquisitions of 3000 fps.

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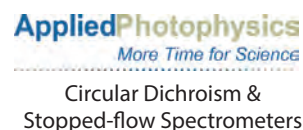
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## Rheometers, viscometers and texture analysers

Lamy Rheology has released a range of rheometers, viscometers and texture analysers. The range has a modern design with a 7" colour touch screen.

The viscometers include models which suit QC applications, such as the B-One Touch and the portable version of this configuration for ease of use in the plant. Portability also applies to the RM 100 Touch model.

High sensitivity is achieved by the innovative LR versions of the models, with the L model going down to 0.0674 mNm and the R model operating from 0.7187 mNm. Models in this range feature a temperature sensor.

The RM 100 Touch meets ASTM/ISO 2555, DIN/ISO3219. The RM 100 Touch Gel Timer is suitable for monitoring viscosity changes in products up to solid state.

For high-viscosity samples, the RM 100 Touch CP2000 is suitable for cone and plate applications and features temperature control. The 100 series includes models for inline applications.

The rheometer models include the RM 200 Touch and the high-performance All-in-One model with torque capabilities to 40 mNm. These suit applications for sample-limited, aerated, high-temperature and high shear rate samples. The LS 400 Touch is based on the Couette geometries and suits low-viscosity, small-volume samples.

The Tex'An Touch texture analyser enables traction and relaxation for food, cosmetics and building materials. This may be configured with different load cells from 20 to 500 N.

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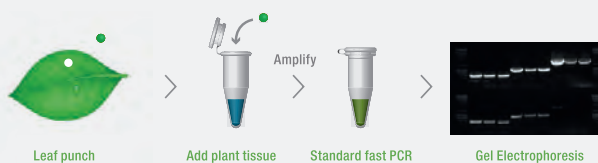
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The Dynamic Vapour Sorption System (DVS) is part of the Surface Measurement Systems UK (SMS) product range of dynamic vapour sorption (DVS) technology and inverse gas chromatography instrumentation and solutions.

The DVS Advantage uses dry air or dry nitrogen as a carrier gas. The user can select one of any two vapour sources, originating from liquid organic solvents or water held at the same temperature as the DVS. When the dry carrier gas passes through a solvent, it becomes saturated with the vapours of that solvent.

Precise control of the ratio of saturated and dry gas flow is enabled with mass flow control combined with the use of real-time vapour concentration monitoring. A known concentration of the selected vapour then flows over a sample suspended from a recording ultramicrobalance, which measures the change in weight caused by sorption or desorption of the vapour molecules. These dynamic flow conditions enable the adsorption/desorption processes to be so rapidly studied.

Applications include: moisture uptake behaviour of food and natural materials; stability and caking of food ingredients; moisture diffusion into blister packaging systems; moisture sorption of hydrophobic pharmaceutical materials; and surface energies and surface areas of powders using organic vapour probes.

Research fields for the complete DVS range are pharmaceuticals (powders, tablets, APIs and excipient materials); food (powders, processed food, biscuits); natural materials (grains/seed, wood); building materials (aggregates, cement, ceramics); personal care products (cosmetics, hair care, contact lenses); and packaging materials (paper, plastics).

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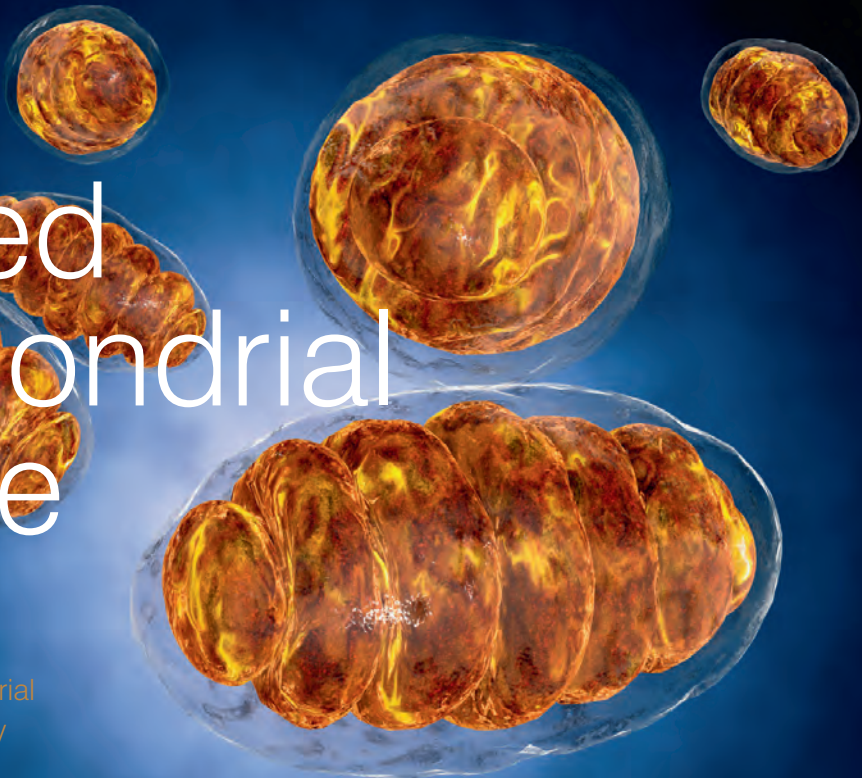
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# Fast test for inherited mitochondrial disease

Rapid diagnosis of mitochondrial disorders is becoming a reality via a new genetic test.



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**T**he team of medics and scientists at the Wellcome Trust Centre for Mitochondrial Research at Newcastle University, together with international collaborators, have identified mutations in a gene, known as TMEM126B, involved in energy production in patients' muscles.

Using next-generation sequencing they have now developed a rapid test which provides a result within 2–3 days — previous techniques took months.

Mitochondrial diseases affect the batteries of the cell and can lead to muscular weakness, blindness, fatal heart failure, learning disability, liver failure, diabetes and can lead to death in early infancy.

Publishing in the *American Journal of Human Genetics*, first author and PhD student Charlotte Alston, who is funded by the National Institute for Health Research (NIHR), describes the technique which has already identified six patients from four families affected by this form of mitochondrial disease.

She said: "Identifying a fault in Complex I, one of the building blocks of mitochondria which is responsible for causing disease combined with our custom gene capture and the latest sequencing technology, means we can screen many more genes to diagnose this debilitating disease.

"It means families can get a rapid diagnosis within days rather than the weeks and months that testing can currently take. For families who are waiting on a genetic diagnosis before trying for another baby, or

they may already be expecting their next child, time really is of the essence."

## Diagnosing mitochondrial disease

Mitochondrial diseases are genetic conditions affecting the batteries of the cell, with around one in 4300 affected children born every year. Symptoms include muscle weakness, blindness, deafness, seizures, learning disabilities, diabetes, heart and liver failure. There is no cure and affected children often sadly die in early infancy.

The research has confirmed the identity of a mutation causing mitochondrial disease affecting Complex I, one of five complexes involved in energy production. The gene, TMEM126B, makes a protein necessary for assembly of the complex, with defects causing problems with energy generation in patients' muscles.

Finding a genetic cause is important to families as it means that they can find out what is wrong with their child, enabling doctors and scientists to help them understand the risks to their future children and help prevent them losing another child.

Professor Rob Taylor from the Wellcome Trust Centre for Mitochondrial Research, who also leads the NHS Highly Specialised Mitochondrial Diagnostic Laboratory at the Newcastle Hospitals NHS Foundation Trust, said: "The diagnosis of mitochondrial disease is often a complicated and time-consuming process. There are over 1300 potential genes that can lead to disease and, as such, finding the genetic cause is sometimes like looking for a needle in a haystack."

## NHS test for affected families

Defective genes can be caused by mutations in either the maternally inherited mitochondrial genome (mtDNA) or, more frequently, the genes located on the autosomes, the 23 pairs of chromosomes which are responsible for all traits and all other genetic diseases. For a family with one child affected with this type of mitochondrial disease, there is a 25% chance of each further child being affected with the devastating condition.

Professor Taylor added: "There is sadly no cure for mitochondrial disease so rapid diagnosis means parents who are wanting to have further children can opt for prenatal testing to ensure future children are healthy and without risk of developing severe disease. It provides options for families at risk of an otherwise incurable disease."

Highly specialised mitochondrial services are NHS funded and streamlined across the country so this genetic test is now available within routine practice to patients nationally.

This research was funded through a National Institute for Health Research (NIHR) doctoral fellowship and made possible through the Newcastle Academic Health Partners, a collaboration involving Newcastle Upon Tyne Hospitals NHS Foundation Trust, Northumberland, Tyne and Wear NHS Foundation Trust and Newcastle University. This partnership harnesses world-class expertise to ensure patients benefit sooner from new treatments, diagnostics and prevention strategies.



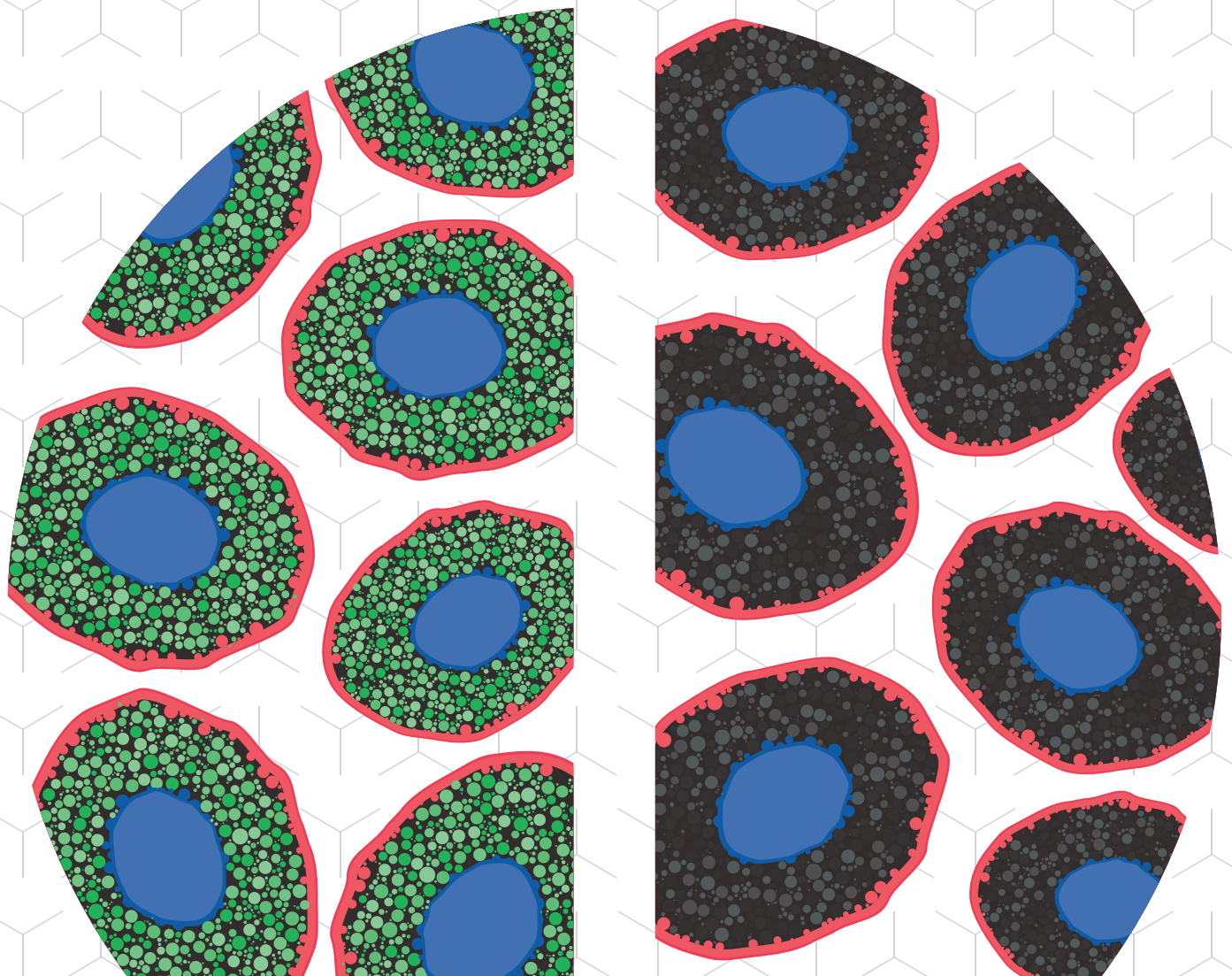
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## CHO and *E. coli* residual DNA quantification kits

Bio-Rad Laboratories has announced the launch of two residual DNA quantification (RDQ) kits to simplify the quantification of host-cell DNA (HCD) in process development, quality control and biomanufacturing processes.

The ddPCR CHO Residual DNA Quantification Kit and ddPCR *E. coli* Residual DNA Quantification Kit allow for direct quantification of host-cell DNA impurities in biopharmaceuticals purified from bacteria (*E. coli*) or mammalian cells (Chinese hamster ovary) without the need for upfront nucleic acid purification steps. The kits are designed for use with the company's Droplet Digital PCR Systems.

HCD levels are tightly regulated in biopharmaceutical products, as high concentrations can potentially pose a safety risk for consumers. Removal of HCD and close monitoring of residual levels throughout the production process must be established to ensure quality and safety of the final biopharmaceutical.

Bio-Rad's CHO and *E. coli* RDQ kits combined with its ddPCR technology provide a convenient system for quantifying HCD with high reproducibility and sensitivity. The system bypasses the need for DNA extraction due to the inherent tolerance of ddPCR to PCR inhibitors, as end-point analysis directly quantifies target molecules and does not depend on amplification efficiency.



The assays also work well with fragmented DNA, which is generated during the manufacturing process and is therefore as important to detect and measure as intact DNA.

Both kits are extensively validated and come with the company's ddPCR Supermix for Residual DNA Quantification, which is produced under strict quality controlled conditions to ensure low background of *E. coli*, mouse, human, yeast and CHO cell DNA.

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## Surface tension measurement instruments

Krüss is a specialist in interfacial chemistry and a supplier of measuring instruments for surface and interfacial tension. The need to perform analysis for research and QA is dependent on 'what' sample parameter needs to be measured. The 'how' to measure is dependent on the samples' presentation. Which instrument to use is dependent on the understanding of the 'what and how'.

The ring method is a widely used technique for measuring static surface tension and static interfacial tension between a liquid and gas (usually air) above the sample. Krüss has a range of instruments which work on the Du Noüy and Wilhelmy plate techniques. The K100, K20 and K11 offer a range of functionalities based on the sensitivity of the microbalance for the model of choice.

When the need is for dynamic test methods such as measuring high-speed events, a bubble pressure tensiometer is a suitable instrument. The BP100 measures dynamic surface tension by analysing the mobility of surfactants, thus enabling high-speed processes such as spraying, coating, printing and cleaning to be optimised. The BP50 has been specially developed for use in QA.

The analysis of coating and wetting processes is important in all aspects in the manufacture of modern goods for aesthetics and functionality. The contact angle of liquid and a substrate interaction gives valuable data for understanding how to develop manufacturing processes to turn materials into commercial goods. The DSA100 provides solution-oriented support in the investigation and optimisation of wetting and adhesion behaviour. The range also includes the DS25 and DSA30 for the diversity of applications.

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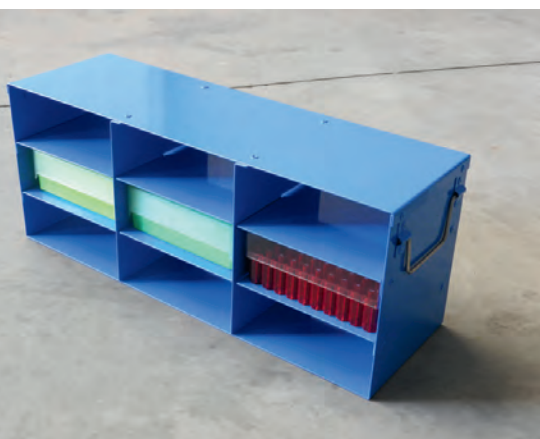
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## Aluminium freezer racks

Interpath Services has available a range of Australian-made aluminium freezer racks for the research and life sciences market.

The company's horizontal racks come with or without handles and are supplied in a variety of configurations to hold 2" and 100-well hinged racks.



Vertical racks come with a top handle and locking rod and hold 2" and 100-well hinged racks. Drawer-style racks hold 2" boxes and are available with three, four or five drawers.

All racks are suitable for use in freezers down to -80°C and quotations for custom products can be supplied on request.

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## DC micromotors

The development of the 3890...CR series is based on the motor concept of the CR DC-Micromotors series with Graphite Commutation from FAULHABER. A powerful neodymium magnet and high copper content in the winding of the rotor provide the compact drive with an enormous amount of power.

For drives in autonomous robot systems, electromechanical orthoses and exoskeletons or power tools like the electric loppers, high dynamics and torque in the smallest possible space are central requirements. The micromotor series features high power density (rated torque per volume), high efficiency and high service life, even with heavy loads. The coreless rotor ensures cog-free, precise synchronisation with low energy consumption.

The series is available with four nominal voltages — 18, 24, 36 and 48 V — enabling a continuous torque of up to 224 mNm to be achieved. The short-term torque, required for many applications, is much higher. With no-load speeds of just over 5000 rpm, the motors are optimally tailored to combination with FAULHABER Precision Gearheads. The standard drive can be combined with an IE3-1024 (L) three-channel encoder or optionally with optical encoders from the HEDx series for applications with precise speed controllers or positioning tasks.

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# Artificial sweeteners make you hungrier



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As well as promoting hyperactivity and insomnia, a new study co-led by the University of Sydney has found that artificial sweeteners actually increase feelings of hunger leading to higher caloric intake.

This is not the first time a link between artificial sweeteners and increased hunger has been suggested, but this new research has identified the brain system that regulates response to sweetness in both insects and mammals.

The first phase of the research was conducted at the Charles Perkins Centre at the University of Sydney. Researchers laced the diet of fruit flies with artificial sweetener and found that after prolonged exposure they consumed 30% more calories when their natural diet was reintroduced.

The University of Sydney's Associate Professor Greg Neely stated: "We found that chronic consumption of this artificial sweetener actually increases the sweet intensity of real nutritive sugar, and this then increases the animal's overall motivation to eat more food."

The researchers determined that the brain's reward centre recalibrates the perceived ratio of energy content to sweet sensation when the sweetness to energy ratio is out of balance for prolonged periods.

Professor Neely said: "Using this response to artificially sweetened diets, we were able to functionally map a new neuronal network that balances food's palatability with energy content. The pathway we discovered is part of a conserved starvation response that actually makes nutritious food taste better when you are starving."

The second phase of the study was designed to determine if the neuronal pathways observed in fruit flies are also relevant to mammals. Professor Herbert Herzog's team at the Garvan Institute of Medical Research exposed mice to a sucralose-sweetened diet for seven days. The mice displayed remarkably similar results to the fruit flies, confirming the same neuronal pathway was involved in regulating overall calorie intake.

Professor Herzog said: "These findings further reinforce the idea that 'sugar free' varieties of processed food and drink may not be as inert as we anticipated. Artificial sweeteners can actually change how animals perceive the sweetness of their food, with a discrepancy between sweetness and energy levels prompting an increase in caloric consumption."

This research was published in the journal *Cell Metabolism*.





# Tumour-derived exosomes

## pave way for 'liquid biopsy'

Innovative research into the role of tumour fragments in the bloodstream could contribute to the development of a blood test for cancer, according to Perth researchers. Such a minimally invasive test has the potential to improve cancer diagnosis and better inform treatment decisions.

**C**oordinated by Dr Annette Lim\* of Sir Charles Gairdner Hospital and The University of Western Australia, the research into tumour fragments (called exosomes) is contributing to the possibility of a 'liquid biopsy' using a blood sample. Such a blood test for cancer would be safer and easier to perform than a tissue biopsy, especially when a tumour is difficult to access for cancers like those that arise in the head and neck.

To support her research, Dr Lim has been named the 2016 recipient of the Royal Australian College of Physicians (RACP) GlaxoSmithKline (GSK) Research Establishment Fellowship in Oncology. Now in its 20th year, the Fellowship is a longstanding and prestigious award from the RACP and GSK.

Exosomes have a diverse range of roles that contribute to the formation of cancer, and so provide opportunities for potential clinical application.

"Exosomal fragments represent the cancerous tumour from which they arise. This means potential

to analyse a patient's blood for DNA, RNA, miRNA and proteins, like a 'liquid biopsy'," said Dr Lim. "Clearly we are focusing on one form of cancer, but imagine if we can deliver benefit to other patients battling other forms of cancer.

"If we can identify reliable molecular markers for cancer in the blood then the potential applications are huge. We can start to think about identifying problems at a pre-cancerous stage and improve tumour surveillance," said Dr Lim. "A liquid biopsy in the form of a blood test is of course safer, less invasive and easier than a tumour biopsy."

Dean of the Royal Australian College of Physicians Professor Richard Doherty says he is delighted to see the RACP GSK Research Establishment Fellowship in Oncology being put to such a valuable project. The Fellowship is a longstanding award born out of a close partnership between the RACP and GSK.

"I commend GSK on their investment in medical science and innovation. This is an important relationship and the College and all of the recipients certainly value the support. It shows how partnerships between industry and the College can be the catalyst for important projects

that drive patient-focused innovations," said Professor Doherty.

GSK in Australia is the sponsor of that part of Dr Lim's work that focuses on the role of exosomes in base of tongue carcinomas.

GSK Medical Director Dr Andrew Weekes said, "It is a great source of pride for the GSK team to be able to support research which advances understanding in oncology. You just never know where projects like Dr Lim's might lead. From first principles, there is potential for meaningful impact in the clinical setting, both in diagnosis and in patient care."

**\*Dr Annette Lim is the recipient of the RACP GlaxoSmithKline Research Establishment Fellowship in Oncology for 2016. Dr Lim will be using the Award to research 'Mechanisms that facilitate metastatic potential in base of tongue carcinomas'. The core funding for Dr Lim's broader project (looking at head and neck cancers more broadly) comes from Garnett Passe & Rodney Williams Memorial Foundation Conjoint Grant ([www.gprwmf.org.au](http://www.gprwmf.org.au)), Cancer Council Western Australia Early Career Investigator award and the WA Health/Raine Foundation Clinician Research Fellowship.**



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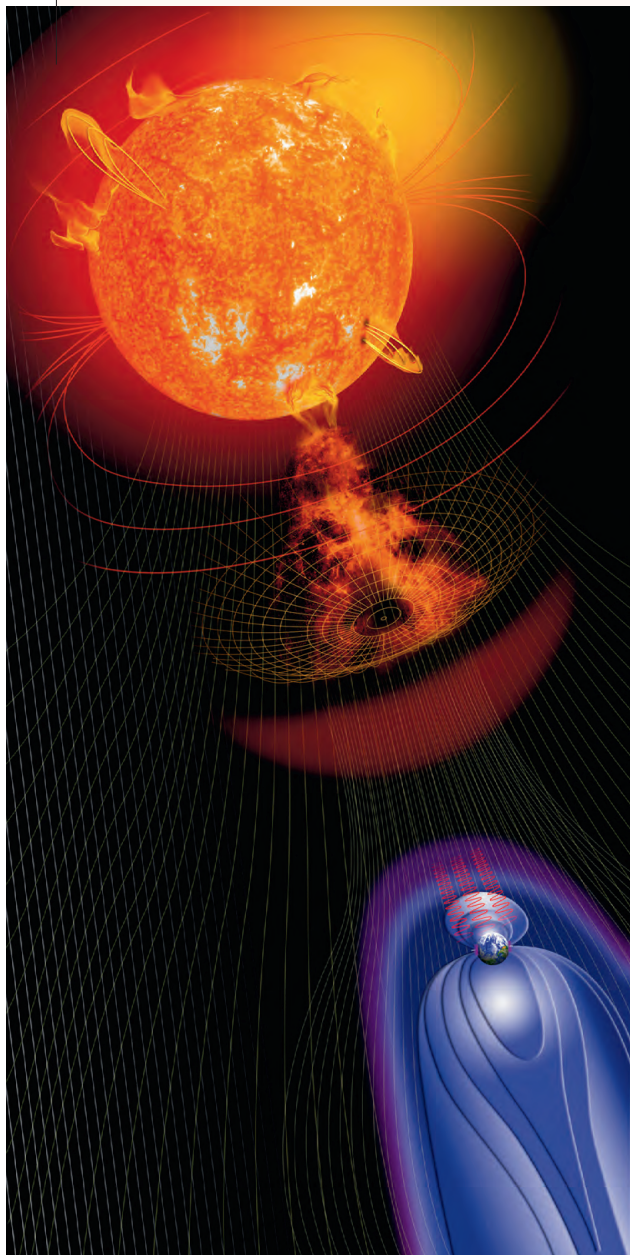
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## Motors on a mission for NASA



As part of NASA's Magnetospheric Multiscale (MMS) research project, motors from FAULHABER are helping to examine the Earth's magnetic field. The mission will, for the first time, provide a 3D image showing how near-Earth magnetic fields disconnect and reconnect.

The mission consists of four identical space probes, launched into space from Cape Canaveral on 12 March 2015, which are flying in various 3D formations in areas of the Earth's magnetic field where magnetic reconnection takes place. This process causes the structure of a magnetic field to change explosively, releasing huge amounts of energy, and is a decisive factor in 'space weather', which in turn affects communications satellites in orbit and electronic equipment on Earth.

Once in orbit, each probe sent out four spherical magnetic field sensors tethered to the probe by 48 m-long cables in order to cover a large measuring range. The cables are unwound by FAULHABER stepper motors as soon as the spacecraft reach their target area.

"You don't get a second chance in space flight," said Michaël Raymond from FAULHABER PRECISTEP in La Chaux-de-Fonds, Switzerland. "The devices on board the probe must perform their task with absolute reliability. For this reason, NASA carried out a special audit on our production and was convinced that our motors satisfy its high requirements in every respect."

These requirements included high performance at a very low weight — every gram counts when a rocket is launched — and in as compact a design as possible. The motor and precision gearhead are just longer than 56 mm, yet the unit generates up to 0.5 Nm at the output shaft.

To ensure that they could operate perfectly in space, the ball bearings of the motors and the gearwheels of the gearheads were lubricated with a special lubricant which can also fulfil its function in a vacuum and at extremely low temperatures. Furthermore, the units comprising the motor and gearhead were given vent holes to allow the air trapped in the housing to escape when they left the Earth's atmosphere so that unwanted differences in pressure were avoided.

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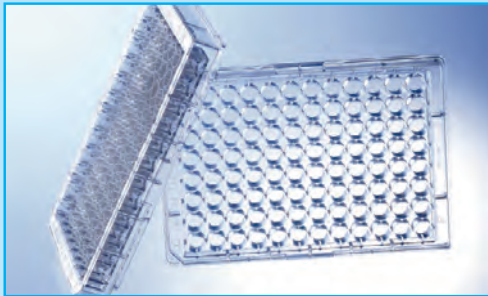
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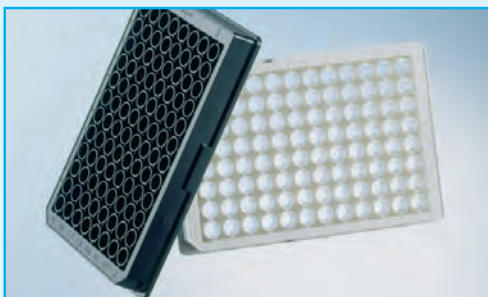
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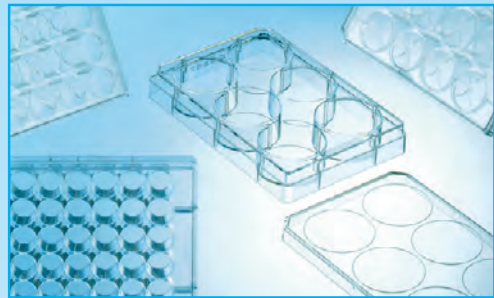
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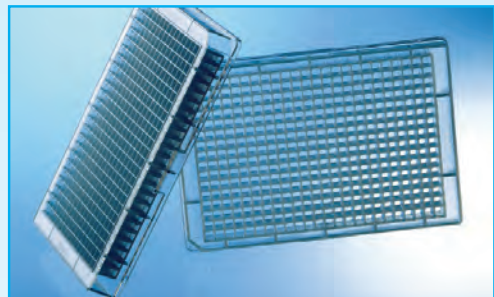
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The instrument lyses thoroughly and quickly any tissues and cells and thus allows easy and reproducible isolation of stable RNA, active proteins and full-length genomic DNA.

The sample tubes remain securely sealed during the processing and the single-use design eliminates cross-contamination. Program parameters are easily set using the touch screen user interface, or users can choose from the 70-plus recommended programs, user-defined saved programs or user-defined custom programs stored on the 5G's onboard computer.

The recommended programs are the heart of the 5G's functionality. These validated programs include all variable assay parameters. This is a valuable optimisation tool for new users and is of special interest to those who are working with pathogenic or dangerous samples, as well as low abundance samples.

FastPrep will homogenise up to 24 samples in 2 mL tubes or, with optional adapters, lyse 48 samples in 2 mL tubes, 24 samples in 4.5 mL tubes, 12 samples in 15 mL tubes or 2 samples in 50 mL tubes making FastPrep a particularly versatile homogeniser. Developed for difficult and resistant samples, FastPrep-24 thoroughly and quickly lyses all tissues and cells providing easy and reproducible isolation of stable RNA, active proteins and full-length genomic DNA.

- **Powerful:** The highest speed available (10 m/s) provides the thorough grinding, homogenising and lyses of the most difficult samples in just a few seconds.
- **Highest yield and purity:** The most DNA, RNA and proteins from any sample type including the most resistant samples. FastPrep-24 5G with FastPrep Kits provide the highest yield and purity. Programmed protocols.
- **Intuitive:** Interactive user-friendly interface and touch screen for easy programming and numerous, >70, recommended pre-programmed protocols for a large variety of applications.
- **Complete solution:** Largest number of ready-to-use Lysing Matrix compositions and FastPrep Kits for DNA, RNA and protein purification of any sample and tissue application.
- **Flexible:** Easily interchangeable adapters to process any sample size (2, 4.5, 15 or 50 mL tubes) at cryogenic or room temperature. Up to 48 samples can be processed at one time under ambient or cryogenic conditions.

The NextGen Sample Prep delivers the most DNA, RNA and proteins from the most resistant samples in 40 seconds or less.





### Thermal indicator

Many types of goods, including food, pharmaceuticals and chemical reagents, must be kept cold while in storage and transit. If goods have been shipped on ice or under refrigeration, it is important to know that those cold temperatures were maintained. Traditionally this has been done with the use of electronic data loggers; however, data loggers are not practical for many applications.

CryoMark, from NiGK, Japan, is a disposable chemical indicator that can be included in every cold shipment. If

temperatures have been exceeded, the indicator will change colour to red. This allows the receiver to confirm that the goods have arrived in good condition, without the need to send back a data logger to the shipper for download and analysis.

The product is easy to use: simply activate and place inside the packaging next to the goods. There are different versions for different temperature cut-offs, so whether goods are frozen or just refrigerated, there will be a suitable CryoMark available.

**Australasian Medical & Scientific Ltd**  
[www.amsl.com.au](http://www.amsl.com.au)

### GPC/SEC system

The Malvern OMNISEC is a multidetector gel-permeation/size-exclusion chromatography (GPC/SEC) system. It is said to be a complete solution for the molecular characterisation of synthetic polymers, natural polymers and polysaccharides and proteins. It combines refractive index, UV/Vis absorbance, light scattering and viscometer detectors to measure concentration, molecular weight and intrinsic viscosity with high sensitivity.

Size-exclusion chromatography (SEC) has become a fixture in biopharmaceutical research and QC labs to provide molecular weight, size, shape, purity and additional information. Protein aggregates are of particular concern, as they can reduce product efficacy and stability and increase immunogenic risk. The combination of a multidetector SEC/GPC system, such as the OMNISEC, and the multi-angle light scattering SEC MALS 20, enables the measurement of the molecular weight of each aggregated species, improving product understanding and supporting biocomparability studies.

The sensitivity of the OMNISEC's light scattering detector enables measurement of molecular weight as low as 200 Da, injection masses as low as 100 ng of material and samples with low dn/dc. The system is available as a detector-only option, which can be connected to any third-party GPC/SEC system. Alternatively, it forms part of a complete OMNISEC GPC/SEC system.

**ATA Scientific Pty Ltd**  
[www.atascientific.com.au](http://www.atascientific.com.au)



### Superlattice LWIR camera

The FLIR A6750sc SLS thermal imaging camera offers high speed, high resolution, ease of use and flexibility in configuration for optimally detecting high-speed thermal events and fast-moving targets. The camera incorporates a high-performance cooled strained layer superlattice (SLS) detector that operates in the 7.5 to 9.5  $\mu\text{m}$  waveband, producing crisp LWIR thermal imagery at 640 x 512 pixel resolution.

Working in snapshot mode, the product is able to capture all pixels from a target simultaneously in less than 190  $\mu\text{s}$  for room temperature scenes. This is particularly important when monitoring fast moving objects, such as in impact testing experiments, where an uncooled thermal imaging camera would suffer from image blur. The camera supports image frame rates up to 4.1k fps when operating in windowing mode.

Offering data capture over a wide temperature range up to 2000°C, the device is designed to be readily synchronised with other instruments and events. Custom cold filtering options for specific spectral detection and measurement are available.

Using a GigE Vision interface to transmit full dynamic range digital video and GenICam for camera control, the product is a true 'plug and play' thermal imaging camera. Additional interfaces include a BNC analog video output. The Gigabit Ethernet and analog video are simultaneously active yet independently controlled, enabling greater flexibility for recording and display purposes.

Using FLIR's ResearchIR software, researchers and scientists can easily monitor, acquire, analyse and share data. Extender rings for zoomed-in fields of view make the camera suitable for imaging small thermal targets, while close-up lenses can detect spot sizes down to 15  $\mu\text{m}$  per pixel.

**FLIR Systems Australia Pty Ltd**  
[www.flir.com.au](http://www.flir.com.au)



# Exterminating antibiotic resistance



Image courtesy of Christian Cable (via Flickr) under CC BY-NC 2.0

A British citizen science project has found a possible new source of antibiotics in the most unlikely of places — a 'Dalek' prop from science-fiction program *Doctor Who*.

With antibiotic resistance one of the biggest threats facing humanity, it is vital that we come up with a solution. With this in mind, Dr Adam Roberts of University College London (UCL) created Swab and Send — a crowdfunding scheme that gives citizen scientists the chance to participate in the search for new antibiotics.

Contributors were sent a pack of swabs that they could use around their homes, their offices or any other weird and wonderful places that took their fancy. The swabs were then sent back to the UCL Eastman Dental Institute, where microbiologists would determine if there was any bacteria present on the swab that had the ability to kill other bacteria. If they did, the scientists would investigate further to see if these bacteria were producing a new antibiotic.

When Swab and Send was featured on a special episode of BBC Radio 4's *Inside Science*, the program's host, Adam Rutherford, went about swabbing various parts of BBC Broadcasting House. Beginning with his own microphone, he moved around the office, along the way taking swabs from the set of the *Today* program, the kitchen sponge

and the revolving entryway doormat. Finally, he swabbed the eyestalk of BBC Broadcasting House's Dalek prop — the plunger-wielding, exterminating, pepperpot-shaped enemy of the time-travelling alien known as 'the Doctor'.

Some time later, when Rutherford visited Dr Roberts' lab, he was presented with two different agar plates: one control plate and one which had been pre-inoculated with a *Micrococcus* indicator strain. The control plate showed all the different bacteria featured on the swabs, while the second plate showed whether these bacteria could kill or prevent the growth of the indicator strain, as demonstrated via a circular zone of clearing around the bacterial colonies.

While there was nothing notable about the more conventional items that Rutherford had swabbed, the Dalek was a different matter altogether, with the control plate indicating that the Dalek swab featured 12 different genera of bacteria.

The more exciting results were on the second plate, where there were clear spots around four of the colonies — all from the Dalek. As stated by Dr Roberts, "We've got at least three different types of bacteria from the Dalek which were able to 'exterminate' our *Micrococcus* indicator strain."

(Ironically, said Rutherford, the Dalek is probably home to so much interesting bacteria due to the fact that so many visitors to the BBC want to touch it — despite the large sign which says 'Please do not touch the Dalek'.)

The next stage for Dr Roberts and his colleagues is to take the Dalek bacteria and analyse it against alternative indicator strains which are more hardy than the weedy *Micrococcus*, such as a strain of *E. coli* which is resistant to about 14 or 15 different antibiotics already.

"That's exactly the type of bacteria we want to be able to kill with new antibiotics," Dr Roberts said. "So we would screen these against that as well. If they kill that one, then we would probably take it a little bit further in our research and try and identify the molecules responsible for the zones of inhibition that you can see on the plates."

With the team having already identified a variety of swabbed bacteria which can kill the indicator strain — 20 of which can also kill the multidrug-resistant *E. coli* — there is a very real possibility that the Dalek could serve as the saviour of the human race. A bit ironic for a creature that normally wants to exterminate every living being in existence!

# 'Omics for all

## Genomic technology conference

The AGTA conference, Australia's foremost genomic technology conference, is an essential event for researchers and industry representatives who work with genomic technologies in a variety of contexts including platform development, medical genomics, functional genomics, non-model systems, epigenomics and plant genomics.

**T**he conference also offers an important opportunity for computational biologists, bioinformaticians and data visualisation specialists to interact with technologists and biologists. This unique mix is one of the reasons that the Australian genomics community has a dynamic cross-disciplinary and innovative approach to genomic analysis, and is at the forefront of analysis tools for new types of 'omics' data.

AGTA/NZ NGS 2016 will attract staff and clients from all genomics core service providers in the region, and beyond, eager to be exposed

to new and evolving technologies, and to hear how those technologies are being applied to genomics research.

AGTA/NZ NGS 2016 will showcase dynamic cross-discipline-omics research and uniquely allow genomics and bioinformatics researchers, as well as industry, to interact over a wide range of topics; these will include technologies focused on genome regulation: biology, phenotype and utility, genomics and agriculture, genome diversity and evolution, human disease and clinical genomics, plant genomics, microbial and single cell genomics and transcriptomics.

### Speaker highlights

The session organisers have invited scientists at the cutting edge of integrative -omics research to present keynote lectures at the conference who will cover topics such as crowd-funded genomics, space missions, cancer, brain development, undiagnosed genetic disorders and the metagenomics of New York City.

*Keynote speakers include:*

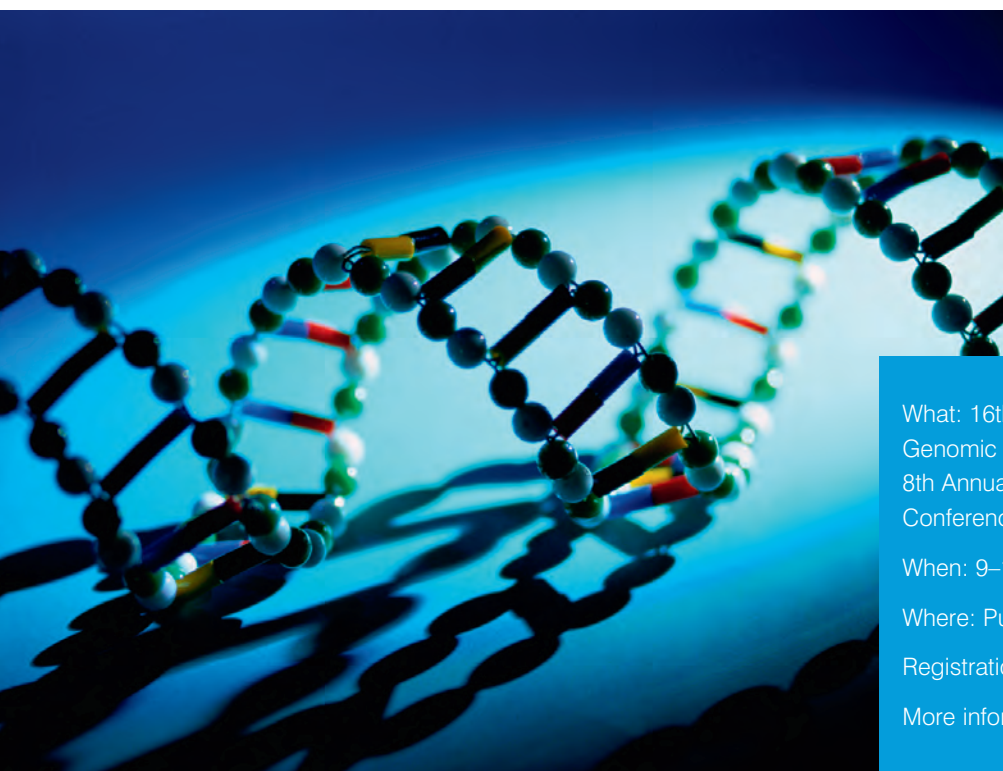
- Associate Professor Beth Shapiro — University of California Santa Cruz, USA
- Associate Professor Christopher Mason — Cornell University, USA
- Associate Professor Huaijun Zhou — University of California, USA
- Associate Professor Lance Miller — Wake Forest School of Medicine, USA
- Dr Richard Edward Green — University of California Santa Cruz, USA
- Professor Gregory Gibson — Georgia Institute of Technology, USA
- Professor Piero Carninci — RIKEN Center for Life Science Technologies, Japan

### Preconference workshops

Two preconference workshops will be held on Sunday, 9 October:

- Bisulfite sequencing: Genomewide methylation sequencing
- Metagenomics: Understanding microbial communities with next-generation sequencing

Delegates can register to attend these workshops when they register to attend the conference.



What: 16th annual conference of the Australasian Genomic Technologies Association (AGTA) and the 8th Annual New Zealand Next Generation Sequencing Conference (NZ NGS)

When: 9–12 October 2016

Where: Pullman Hotel, Auckland, New Zealand

Registration: [www.agtaconference.org/registration](http://www.agtaconference.org/registration)

More information: [www.agtaconference.org](http://www.agtaconference.org)





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# Genomics to disrupt business as usual in the clinical laboratory

The discovery of the genetic code, with its unique signature for every living organism, has until recently had limited application in the routine clinical laboratory and for the man in the street. This is set to change as advances in genomics technology make it more accessible and public awareness of its benefits grows.

Looking at DNA is highly specialised, but technology improvements including automation, miniaturisation and cost reductions that occur with scalability have moved the utility of genetic information out of research and into mainstream clinical laboratories. Affordable, high-throughput genomic technologies enable rapid provision of results and expanded commercial platforms. This process is likely to accelerate, challenging the capacity of the clinical laboratories with new work processes and a requirement to store massive amounts of genomics data and maintain its integrity.

When the human genome project was completed in 2003, the next obvious question was 'what can we do with this information?' Finding the causes of some of the common hereditary diseases like cystic fibrosis was a logical starting point, but has since then been broadened to include many other common conditions. Research into various cancers and the push to find suitable treatments for other previously difficult-to-treat diseases has also been targeted for investigation. Preventative strategies like surgical removal of non-essential, cancer-prone tissue like breasts in familial risk groups have now become popular. So if it is written in our genes, we can now know and do something about it.

## Genomics and personalised medicine

The interest in using genomics for personalised medicine has expanded rapidly and even health funders in some countries are joining the discussion, as they believe there is a cost-benefit to do the testing for preventative health before expensive curative medicine is required. The caveat is the ongoing ethical debate around who should have access to what information, the potential for discriminatory use and unintended consequences of knowing for the patient. Not surprisingly, there is also an increased sensitivity to and awareness of security in the population around genetic testing.

However, many of the everyday genomic tests that will increasingly be performed in clinical laboratories will analyse the genetic make-up of tumours, not patients. Laboratories will help to deliver personalised medicine by identifying a cancer tumour down to its genetic code so clinicians can target the most appropriate treatment. With genomic analysis, many tumours can already be sub-typed and matched to treatments yielding the best clinical outcomes, and research is ongoing for an ever-expanding range of cancers.

## Genetic testing of pathogens

There is also the emergence of genetic testing of bacteria and other infectious organisms, with

dramatic improvements in turnaround times. With genetic testing, traditional microbiology tests that take 48–72 hours can be reduced to hours so that prompt, targeted treatment can be assured. In the case of slow-growing tuberculosis bacteria, there has been a massive reduction in turnaround time as tests that used to take up to seven weeks are now performed in two hours through genomics.

As the pricing comes down for these tests, there will be a fundamental change in how pathology will deal with tumours, microbiology tests and even blood groups. DNA screening tests for an individual that used to cost hundreds of thousands of dollars are now approaching US\$1000. And while genomic tests for cancers, for example, are still more expensive than this, the higher success rates they result in for treatment can make for a compelling cost-benefit analysis.

Advances in technology have made DNA sequencing platforms accessible to clinical laboratories that were once solely the preserve of high-tech research laboratories. Hospitals that used to send colonic tumours away to highly specialised labs are now asking, 'why can't we do that here?' As medical care decisions become more precise and personal, laboratories will increasingly be required to provide genomic testing services and this will also influence their choice of information systems.







Advances in technology have made DNA sequencing platforms accessible to clinical laboratories that were once solely the preserve of high-tech research laboratories.

### Laboratory systems challenges

The need to incorporate genetic information about an individual into their electronic medical record will no longer be a nice to have, but necessary to deliver a clinical service. Dealing with the data in a way that meets the exponential increase in demand for secure storage as well as ready accessibility for analysis is also challenging clinical laboratory information management systems, or LIMS.

Some of the key issues are already accommodated in current laboratory processes. These include security of patient demographics, accurate identification of tissue and specimens, long-term storage requirements of specimens and some analytics. But traditional LIMS were not designed to cope with the new bioinformatics demands for storage or analysis, for example, with a typical genomics test generating a file 30–70 MB in size.

Risk mitigation also requires traceability of all aspects of the process. Ensuring full auditability and adherence to standard operating procedures are crucial criteria for a laboratory management system. When laboratories perform a genetic test, you must retain evidence of who handles the sample at every point of processing, how it has been stored and the complex

workflows. Many LIMS today will not handle that sort of complex requirement for chain of custody.

### New breed of system required

Providing security of the information and allowing access to authorised healthcare workers via the electronic medical record (EMR) provides more complexity. All these considerations need to be part of any evaluation of new systems as legacy applications have not been designed to cope with this disruptive demand. This is necessitating a new breed of system, which InterSystems calls a laboratory business management system (LBMS).

Features of an LBMS required to fully support genomic testing in clinical laboratories include:

- support for connected care models, with a contiguous pathology patient record integrated within the electronic medical record, including genomic data;
- configuration and enforcement of standard operating procedures (SOPs), including sample preparation and chain of custody for genetic testing, with full auditability within the system;
- access to virtually unlimited amounts of low-cost data storage, while maintaining high levels of system performance, fully controlled and secured within the system;

- the ability to perform complex analytics on genomics data without the requirement to purchase or integrate with third-party solutions.

The nature of the laboratory business is changing dramatically and genetic testing is one of the major drivers. Genomics is becoming more prevalent, and its growth will accelerate as its diagnostic and therapeutic use become even more evident. As a result, the ways in which clinical laboratories have traditionally performed their work will change significantly over the next 2–5 years. While the pressure to deliver new services will intensify, advanced information technology solutions will let laboratory professionals be the drivers of change, not the victims.

*\*Gene Elliott is the Johannesburg-based Physician Executive for InterSystems in South Africa.*

*^Martin Wilkinson is the Sydney-based Director of Product Introduction, Strategy and User Adoption for InterSystems. Originally trained as a biomedical scientist in the United Kingdom, he is global head of the company's solutions for the laboratory market.*

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# Accelerate Synthesis

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## Cell culture platform

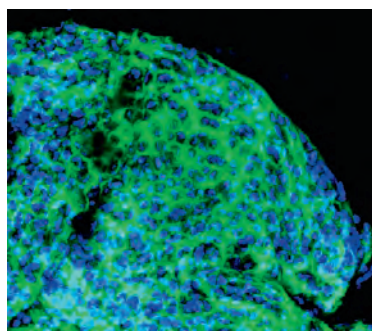
Tecan and CellSpring are automating the 3D Bloom platform on a Freedom EVO workstation. The collaboration will extend Tecan's automated 3D cell culture portfolio, allowing scientists to take advantage of a high-throughput technology with an extended cell viability period of at least seven days in the assay matrix.

The adaptive 3D Bloom Biopolymer Platform is compatible with all cell types and is suitable for both mono and co-culture assays. 3D microtissues can be prepared in microplate format within minutes and analysis carried out while still in the culture matrix.

The implementation of the microplate-based platform on the Freedom EVO workstation will allow scientists to benefit from straightforward, high-throughput automation of a 3D cell culture process offering long-term cell viability.

**Tecan Australia**

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



## Portable Raman spectrometer

The i-Raman portable Raman spectrometer is a high-resolution, TE-cooled, fibre-optic Raman system. Combining high resolution with field portability, the product's performance is comparable to large benchtop Raman systems. It weighs less than 3.2 kg.

The spectrometer is equipped with B&W Tek's CleanLaze technology for good laser stabilisation and narrow line width. Other features include a spectral resolution as fine as 3.5  $\text{cm}^{-1}$ , wide Raman shift coverage up to 4000  $\text{cm}^{-1}$  and a TE-cooled, 2048-pixel CCD array. With a convenient fibre-optic interface, it can collect data to within 65  $\text{cm}^{-1}$  of the Rayleigh line. The system's small footprint, lightweight design and low power consumption provide research-grade Raman capabilities anywhere.

The system offers 532 and 785 nm excitation wavelength options. It also features a TE-cooled CCD detector, allowing the maximum effective integration time of several minutes. This makes the product suitable for demanding applications involving low concentrations and weak Raman scatters.

Applications include: bioscience and medical diagnosis; polymers and chemical processes; food and agriculture; geology and mineralogy; pharmaceuticals; environmental science; Raman microscopy; forensic analysis; gemology; art and archaeology; teaching; quality control; and general research.

**SciTech Pty Ltd**

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



## Online endotoxin training course

Lonza has announced the release of the Overcoming Interference e-Learning Module for its QC Insider Toolbox, which covers the causes of interference in the bacterial endotoxins test (BET) and provides the user with solutions to help ensure compliance.

Being able to overcome the inhibitory or enhancing properties of a sample is required by the BET monograph, the validation of which forms part of the test for the final product release of injectable drugs and medical devices. Many of the pharmaceutical products that are either in use or being developed today have characteristics that cause them to interfere with the BET.

Some components of a test solution can interfere with the BET assay. Pretreatment of samples is an important aspect in overcoming interference as a simple dilution will usually solve the issue; however, the Overcoming Interference e-Learning Module helps QC professionals respond to situations when dilution alone is not sufficient to overcome interference.

The e-Learning Modules, launched as part of the QC Insider Toolbox, are a suite of online endotoxin training courses designed to deliver the technical knowledge that quality control professionals need to achieve success with BET. Each interactive module can be taken at the user's convenience and, on completion of a knowledge test, the learner will receive a certificate of completion for their training records.

**Lonza Australia Pty Ltd**

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



## Semiautomated liquid handler

Every laboratory has tasks that are too small to automate and too large to accomplish by hand. The Microlab 600 is a semiautomated liquid handler designed specifically for these in-between applications, increasing throughput and consistency while reducing wasted buffer.

The product is a diluting and dispensing system based on Hamilton's precision syringes. The positive displacement system is claimed to provide better than 99% accuracy, independent of a liquid's viscosity, vapour pressure and temperature. It is suitable for industries such as forensics, environmental analysis, mining, manufacturing and many more.

The product automates the pipetting process. Methods established by a lab manager are stored in the controller and are consistently run by all technicians. It therefore eliminates volume adjustment mistakes and variability in technique, while simplifying compliance to EPA, FDA (GLP, GMP) and ISO regulations.

The Microlab 600 Advanced features a comprehensive compliance package — a free software update that provides a variety of security protections, simplifies adherence to FDA GXP regulations and has the ability to administer user accounts and passwords, create log files that conform to 21 CFR Part 11 and manage log files on a PC using the LyncStore application.

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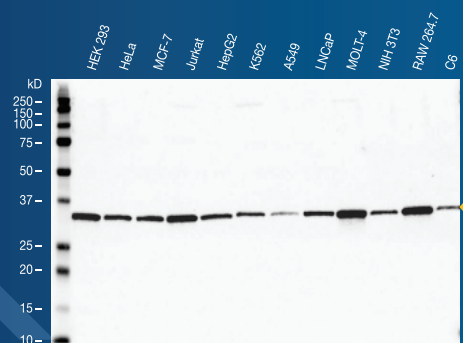
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## Hand-operated vacuum pumps

Kartell manufactures hand-operated vacuum pumps (Art 1398) for vacuum filtration or physics experiments. The vacuum pumps are manufactured to be light and portable and are designed for pulling a partial vacuum of up to 625 mm Hg.

The pumping rate is 15 mL per stroke and the product includes a built-in vacuum release valve. The vacuum hand pump can be used as a pressure pump by transferring the release valve cap to the vacuum port. The nozzle fits to 6 mm ID tubing.

The company's hand-operated vacuum pumps are also available with vacuum gauges (Art 1399).

**Sieper & Co Pty Ltd**

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## Premade stable cell lines

GeneCopoeia carries a comprehensive suite of premade stable cell lines. Each of the stable cell lines is provided in a number of widely studied cancer cell lines, providing useful tools for studying cancer properties and development of effective therapies.

CRISPR-Cas9 Stable Cell Lines are available premade in human cell lines H1299, HEK293T, HeLa and A549, and mouse cell line Neuro2a. They are stably integrated into the human AAVS1 and mouse ROSA26 'safe harbour' sites.

Luciferase+GFP Dual Labeled Cancer Cell Lines express high levels of luciferase and GFP. They offer sensitive, non-invasive detection of cancer cell growth and progression in vivo.

GFP Labeled Cancer Cell Lines are suitable for in vivo tumor monitoring without the need for substrate perfusion. They can also be used for in vitro visualisation and immunocytochemistry.

Cell Structure Related Stable Cell Lines stably express cell structure-related proteins, fused in-frame to RFP.

**United Bioresearch Products Pty Ltd**

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

## Flow cytometer with green laser

MilliporeSigma has expanded its line of Guava easyCyte flow cytometers to include a high-power modulated green laser. The system combines the green laser, higher power violet, blue and red lasers for detecting subcellular particles as small as viruses, low waste volume and a small footprint.

The addition of the 532 nm laser expands the detection capabilities of the instrument to enable simultaneous detection of multiple fluorescent proteins. It allows users to analyse heterogeneous biological tissues and systems in a single experiment and offers more spectral choice using fluorescent reagents.

The enhanced optical capability and flexibility has been achieved with no increase in instrument size. Better optical configurations allow for more meaningful analysis and permit a small benchtop footprint. This gives users reduced buffer and sample volumes and reduces waste when compared with sheath-based flow cytometers, according to the company.

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The Optima AUC is a fast, sophisticated and easy-to-use analytical research tool. It lets molecules float free and unbound, letting users characterise them in their native state. A large touch-screen display (visible from across labs) eases operation and boosts efficiency. Modern, intuitive software allows for simple run monitoring and data exports performed either locally or remotely.

Applications include molecular weight, stoichiometry, protein aggregation, ligand binding, conjugation efficiency and polydispersity.

**Beckman Coulter Australia**

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

### Large unilamellar vesicle preparation

Avanti Polar Lipids introduces the Mini-Extruder, which prepares large unilamellar vesicles (LUVs) by extrusion in an efficient and rapid manner. LUVs are useful for the examination of model membrane systems and are also used in drug delivery research.

The optional heating block, which can be used in conjunction with the product, allows the extrusion of unilamellar vesicles at elevated temperatures. This is critical for the successful production of vesicles from phospholipids. Constructed of stainless steel and Teflon, this design allows rapid cleaning of all wetted parts, which reduces the downtime between production of vesicles from different lipid species.

The unit has a convenient design, allowing for rapid cleaning. The particle size distribution of LUV preparation is a function of the number of passes through the extruder membrane.

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## Virus-retentive filter for cell culture media

Sartorius Stedim Biotech (SSB) has launched Virosart Media for virus retention in cell culture media. With the media filter, the company offers a fast solution for manufacturers to reduce the risk of virus contamination resulting from raw materials, such as chemically defined media, during fermentation.

The first product of the family is a lab filter with a filtration area of 5 cm<sup>2</sup> for downscale, flow and capacity studies. The single-use filter provides a high level of safety for customers'

upstream processes as it is qualified for >4 log<sub>10</sub> reduction of small, non-enveloped viruses (eg, MVM) and as a mycoplasma and leptospira retentive filter. Mid-scale (0.29 m<sup>2</sup>) and process filters (1 m<sup>2</sup> and 3 m<sup>2</sup>) will also be qualified as a sterile filter based on the current ASTM guideline.

**Sartorius Stedim Australia Pty Ltd**

[www.sartorius-stedim.com](http://www.sartorius-stedim.com)

## Industrial videoscope

The iPlex NX industrial videoscope, from Olympus, can help locate flaws that were previously undetectable, as well as streamline inspections in difficult-to-reach areas. The scope combines a high-pixel CCD chip, an ultrabright laser diode light system delivered through the tip of the probe and Olympus' PulsarPic processor to automatically adjust light output, delivering clear images in changeable inspection conditions.

The product can measure areas up to four times larger than conventional scopes, according to the company. It also offers a multispot-ranging function that enables measurement of the distance from the scope tip to multiple points on the inspection surface. This provides real-time surface shape information with no pause or break in the inspection.

The camera can be controlled remotely by an operator while it is inserted in the cavity to be inspected. Olympus' TrueFeel electric articulation has been enhanced with reduced mechanical lag and greater sensitivity, giving the product ultraresponsive articulation and an increased range of motion in four directions.

The user has a choice between the touch screen or the ergonomically designed manual controls to suit the environment and inspection application. The touch screen is manoeuvrable for optimised ergonomics and viewing comfort, allowing for more than a dozen commonly used functions to be changed with a single touch.

The product is suitable for locations with limited operator access, including boilers, aeroplane fuselages and engines, and wind turbine gear boxes. The compact and robust construction has achieved an IP55 rating and complies with stringent US military standards for dust and rain resistance, as well as drop testing.

**Olympus Australia Pty Ltd**

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



## UHPLC system

Researchers looking for fast and consistent results can now benefit from the latest ultrahigh-performance liquid chromatography (UHPLC) system from Thermo Fisher Scientific to boost their LC and LC-MS performance.

The Thermo Scientific Vanquish Flex Binary UHPLC system adds a binary solvent delivery option in the 1000 bar (15,000 psi) performance range. Built for high-speed, fast-gradient applications, the system is suitable for laboratories performing qualitative and quantitative LC or LC-MS analysis that need to increase sample throughput. Ease of use and innovative technologies make UHPLC widely accessible and enable easy and effective method transfer from established systems and applications.

The system was developed with speed, sensitivity and quality results in mind, providing the level of operational efficiency required by today's researchers. It provides high LC and LC-MS performance together with the company's products for sample preparation, reagents, columns, mass spectrometry and data processing.

The unit features a binary high-pressure gradient pump with two 3-solvent channels and low-gradient delay volume capable of delivering high flow rates of up to 8 mL/min. The entire system provides a biocompatible flow path, SmartInject using intelligent sample pre-compression, selectable thermostating modes and a range of detection capabilities.

**Thermo Fisher Scientific**

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





### Imhoff sedimentation cone and stand

Kartell manufactures Imhoff sedimentation cones for the analysis of settleable solids in water.

The Imhoff sedimentation cone is made crystal clear with permanently moulded graduations. It features an easy-drain function using a PP screw plug located at the base of the cone. The cone has a 1000 mL capacity.

The company also supplies an Imhoff cone stand that holds two Imhoff sedimentation cones. It is lightweight and is easy to carry.

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### Benchtop hypoxia workstation

By delivering a compact, contamination-free environment that offers precise and continuous control of oxygen, CO<sub>2</sub>, temperature and humidity, the HypoxyLab delivers a powerful solution to research and industry looking to reproduce representative physiological conditions in cell-based research.

It is the partial pressure of oxygen (not merely the % oxygen concentration) that cells actually 'see' when cell cultures are exposed to oxygen. The product adopts this fundamental scientific principle and controls the chamber environment using the partial pressure of oxygen (pO<sub>2</sub>) expressed directly in SI units of mmHg or kPa.

The partial pressure of oxygen varies not only with oxygen concentration, but also with altitude and prevailing weather patterns. This approach is claimed to make HypoxyLab the most faithfully accurate hypoxia workstation available.

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# Innovations in medical science

## AACB AIMS 2016 Combined Scientific Meeting

# W

ith the conference theme 'Innovations in Medical Science', the AACB 54th Annual Scientific Conference and the AIMS 46th National Scientific Meeting have combined to create an exciting meeting with an outstanding program of keynote international and local speakers, a number of oral and poster opportunities, a great social program and an extensive industry exhibition.

The scientific program runs over three days and includes plenary and concurrent sessions, multidisciplinary sessions, workshops, industry symposia, posters and oral sessions.

Sessions and topics being covered include: Liver fibrosis markers, Anti-microbial resistance/stewardship, Emergency haematology, Cancer markers, Advances in laboratory testing during pregnancy, Quality assurance, The Frozen Blood Project and more.

### Workshops:

- Pre-analytical
- Coagulation
- Antibiotics and antibiotic resistance

### Satellite meetings

- AACB 5th Harmonisation Workshop: 12 September
- Chromatography Mass Spectrometry (CMS) Satellite Meeting: 16 September
- Quality Control Workshop Part 4: 16 September

### Keynote speakers:

- David Rothfield Memorial Oration: Professor Jeremy K Nicholson, Professor of Biological Chemistry, Head of the Department of Surgery, Cancer and Interventional Medicine, Director of the MRC-NIHR National Phenome Centre, Director of the Centre for Gut and Digestive Health (Institute of Global Health Innovation), Faculty of Medicine, Imperial College London.
- David Curnow Plenary Lecture: Associate Professor Ken Sikaris, Chemical Pathologist,



When: 13–15 September 2016

Where: Brisbane Convention & Exhibition Centre

Register to attend: [www.aacb.asn.au/eventsinfo/aacb-aims-registration](http://www.aacb.asn.au/eventsinfo/aacb-aims-registration)

More information: [www.aacb.asn.au/eventsinfo/aacb-aims-2016](http://www.aacb.asn.au/eventsinfo/aacb-aims-2016)

Melbourne Pathology; Director of Clinical Support Services, IT Division, Sonic Healthcare, Melbourne.

• Mr Paul Epner, Executive Vice President, Co-Founder & Director, Society to Improve Diagnosis in Medicine; Chair, Coalition to Improve Diagnosis, USA.

• Prof Stefan Grebe, Professor of Laboratory Medicine & Pathology, Mayo College of Medicine USA.

• Dr Lester Levy, Chairman, Auckland and Waitemata District Health Boards, the Health Research Council and Auckland Transport, Auckland NZ.

• Dr Delia Nelson: Senior Research Fellow, Faculty of Health Sciences, School of Biomedical Sciences, Curtin University, Perth.

• Colonel Michael Reade: Defence Professor of Military Medicine and Surgery, Joint Health Command.

• Director of Clinical Services, 2nd General Health Battalion, Qld, Australia.

• Professor William Rosenberg: Peter Scheuer Chair in Hepatology, University College London; Clinical Lead for Viral Hepatitis, Royal Free Hospital, London.

• Dr James Winearls: Consultant Intensivist, Gold Coast University Hospital, Gold Coast.

### AACB

The Australasian Association of Clinical Biochemists (AACB) was founded in 1961 with the following objectives:

- To advance the study and practice of clinical biochemistry.
- To disseminate knowledge of the principles and practice of clinical biochemistry.
- To protect and promote the interests of clinical biochemists.

### AIMS

The focus of the Australian Institute of Medical Scientists (AIMS) is to equip medical diagnostic professionals with the tools, information and networks to ensure the provision of quality and world-class medical science services in Australia and overseas. The professional body represents all disciplines of medical science and the community of over 23,000 medical diagnostic professionals working throughout Australia.





### High-throughput mass spectrometer

The SCIEX QTRAP 6500+ LC-MS/MS System achieves improved sensitivity and selectivity over previous-generation systems for small

molecule quantitation. It integrates with

the BioBA Solution for large molecule quantitation, creating a powerful workflow system for biologics bioanalysis.

The system offers features that improve small and large molecule quant, such as the multicomponent IonDrive Technology with the IonDrive High Energy Detector+ (HED). The increased detection area delivers sensitivity improvements in positive mode ionisation and negative mode ionisation in the low mass region, depending on the analyte.

The system delivers enhanced selectivity without compromising MRM sensitivity. The QTRAP scan function of MS3 (MS/MS/MS) adds an additional level of mass filtering, while the SelexION+ ion mobility technology provides an orthogonal separation prior to mass separation. The SelexION+ system has a 2x increase in ion transmission and offers labs yet another tool for eliminating isobaric background interferences in complex assays, making quantitation in complex samples easier and less time-consuming. The scan functions offered by the system, including enhanced mass scans (EMS), enhanced resolution scans (ER) and enhanced product ion scans (EPI), deliver maximum flexibility and workflow options for researchers whose work extends beyond quantitation alone.

The sensitivity and selectivity delivered by the device is designed to help users see it all — from low mass to high mass compounds, in positive or negative polarity — in a single injection, not only in small and large molecule bioanalysis, but also across applications such as comprehensive food residue monitoring, environmental analysis, lipid analysis and forensic drug screening.

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### qPCR assays and primer pairs

ExProfile Pathway Gene qPCR Arrays from GeneCopoeia profile the expression of pathway-related genes, which are carefully chosen for their close pathway correlation based on a thorough literature search of peer-reviewed publications.

In each 96-well catalogue array plate, there are up to 84 pairs of All-in-One qPCR primers, which have been pre-validated and deposited in designated wells. In each plate there also are 12 wells of controls for monitoring the efficiency of the entire experimental process: from reverse transcription to qPCR reaction. Every qPCR primer pair from GeneCopoeia is wet-lab validated.

The product is a robust and easy-to-use tool for gene expression profiling. It features uniform reaction conditions for every assay and high amplification efficiency, with no non-specific amplification and no primer dimers.

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

### 2D image analysis software

Image-Pro Premier, by Media Cybernetics, is a 2D image analysis software package that offers intuitive tools that make it easy to capture, process, count, measure, analyse and share images and data. The Image-Pro Premier v9.2 offers 64-bit support, a user-friendly interface and a suite of 2D measurement solutions.

The software's technique for performing automatic measurements is suitable for gathering data from images by segmentation systems. It is used worldwide by thousands of researchers and imaging professionals in a wide range of applications including life science research, pathology, fluorescence imaging, ring analysis and ageing, cell biology, industrial inspection, quality control, particle analysis, forensics, etc.

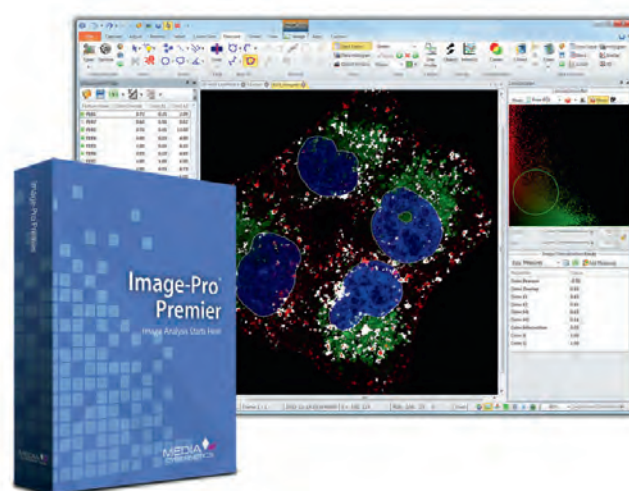


Image-Pro Premier v9.2 is packed with tools that provide the power to process and analyse images. It enables the user to create, download and share custom apps; capture single images and movies; process and enhance images; measure distances and areas; track objects; measure intensity; automatically count and classify objects; automate tasks; and share work.

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## Nanofabrication technology

The NanoFrazor Explore thermal Probe Scanning Lithography (t-SPL) system can produce 2D and 3D nanostructures in a single step. The unit can operate in ambient conditions and has no requirement for high voltage. It is said to offer advantage over electron beam lithography (EBL) systems, which are typically bulky and require ultrahigh-vacuum environments with high-voltage supplies.

SwissLitho's technology uses a sharp tip, similar to an AFM tip, which heats a localised area, resulting in decomposition and effectively machining the surface of the resist material. The tip, which has a radius better than 5 nm, is able to create a high-resolution nanopattern. The system has the ability to operate in closed-loop lithography mode. This enables the user to simultaneously pattern and measure a sample, providing instantaneous feedback on the patterning process.

The patterning depth can be controlled with nanometre accuracy, which enables direct patterning of 3D nanostructures in a single step. It also eliminates the need for subsequent imaging of a sample after patterning. Furthermore, the latest stitching and overlay methods achieve sub-5 nm accuracy without the use of artificial marker structures.

The heated tip in the lithography process does not deposit charged particles like electrons or ions into the sample. For dedicated nanoelectronic devices, this can result in good device performance. The instrument is easy to use due to a smart software architecture and user-friendly graphical user interface that simplifies many complex functions. This enables high-resolution, nanometre-sized geometries to be quickly prototyped.

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## 10 mm motors

FAULHABER has launched a series of metal brush commutated motors, the 1024...SR series, with a diameter of 10 mm. In combination with a gearhead, its output torque can achieve 300 mNm — said to be twice that of similar products on the market.

Due to a good torque/speed ratio (flat slope), the motor can handle varying loads at reduced speed variations, thus granting smooth control. This performance is achieved with low noise and vibration levels. A wide range of matching speed and motion controllers, encoders and gearheads allows for optimal adaption in high-demand applications like portable devices or optical equipment.

The improvement in power and torque achieved by the series is based on a redesign of nearly all of the motor's elements, including a new coil, commutation system and magnet. This results in a wider speed range under load, delivering a continuous torque of 1.5 mNm at 7500 rpm and exhibiting an output power above 3 W. The voltage can be chosen between 6 and 12 V.

Suitable for high-demand applications, the motor's ability to offer high performance with small dimensions and low weight makes it a good choice for portable devices. Its low vibration levels enable its use in high-accuracy applications, such as in optical equipment or high-precision tools. An optional ball bearing version makes it suitable for applications with radial loads. The motor is also available with a second shaft end, in a vacuum and in an extended temperature range version (-30 to +125°C).

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## Calcium assay kits

Measurement of transient calcium mobilisation from intracellular stores in response to the activation of G protein-coupled receptors (GPCRs) is considered a standard approach to the pharmacological characterisation of receptors and compounds, frequently implemented in primary screening and lead development programs.

Enzo's FLUOFORTE Calcium Assay Kits detect mobilisation of intracellular calcium utilising a fluorogenic calcium-binding dye optimised for good cell permeability and retention. Developed for use with conventional dual-dispensing microplate readers, the kits provide EC50 values comparable to Fluo-4 and Calcium 4.

FLUOFORTE dyes are claimed to offer two-fold brighter fluorescence vs Fluo-4, enabling the detection of weak signal compound responses. The sensitive dye provides a large assay window, allowing for the detection of even weak signal compound responses. Optional red dye enables multiplexing with green fluorophores.

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# Bionic leaf 2.0

A team from Harvard University has created a 'bionic leaf' that converts sunlight directly into a biomass fuel with 10 times the efficiency of natural systems. Using solar energy to split water molecules and bacteria that eats hydrogen to produce liquid fuel, the system converts sunlight to biomass with 10% efficiency, compared to the 1% efficiency found in nature.



“

If you think about it, photosynthesis is amazing,” said Daniel Nocera, the Patterson Rockwood Professor of Energy at Harvard. “It takes sunlight, water and air ... and then look at a tree. That’s exactly what we did, but we do it significantly better, because we turn all that energy into a fuel.”

Nocera is calling this new system ‘bionic leaf 2.0’ as it is a vast improvement on his original ‘artificial leaf’, which used solar energy to make isopropanol but was hindered by its use of a nickel-molybdenum-zinc alloy catalyst that produced hydrogen but also created reactive oxygen species molecules. This required the system to be run at abnormally high voltages to prevent the destruction of the bacteria’s DNA.

Bionic leaf 2.0 uses a new cobalt-phosphorous alloy catalyst that can be run at a lower voltage, leading to a dramatic increase in efficiency. Co-author Pamela Silver, the Elliott T and Onie H Adams Professor of Biochemistry and Systems Biology at Harvard Medical School, said: “These catalysts are totally biologically compatible.”

She believes bionic leaf 2.0 will have a wide range of possible commercial applications: “In principle, we have a platform that can make any downstream carbon-based molecule. So this has the potential to be incredibly versatile.”

As well as isopropanol, bionic leaf 2.0 is also able to produce isobutanol, isopentanol and the bioplastic precursor PHB. For developments in this field, the team are indebted to the pioneering work of MIT Professor Anthony Sinskey.

Funding for this project was aided by the First 100 Watts program at Harvard, and the team are keen to share this technology with scientists in the developing world.

Published in *Science*, the paper’s lead authors include postdoctoral fellow Chong Liu and graduate student Brendan Colón. Funding was provided by Harvard University Climate Change Solutions Fund, the Wyss Institute for Biologically Inspired Engineering, the Office of Naval Research Multidisciplinary University Research Initiative Award and the Air Force Office of Scientific Research Grant.

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## Handheld digital storage oscilloscopes

The latest additions to the ISO-TECH range of two-channel digital storage oscilloscopes include the IDS-200 and IDS-300 handheld DSOs, which are suitable for electrical installation engineers and site maintainers.

The IDS-200 and IDS-300 series feature touch-screen capacitive-LCD technology, which enables fingertip control of the device. Using only one finger, a waveform can be moved and a line position can be triggered, while using two fingers allows the adjustment of voltage levels and time-division scales. The touch-screen technology also offers an intuitive menu that enables operations such as fingertip control over the location of measurement functions and the ability to save and retrieve both diagrams and data.

The DSOs offer a maximum sample rate of 1 GS/s and are available in entry-level models — the IDS-207 70 MHz, IDS-210 100 MHz and IDS-220 200 MHz — and advanced models — the IDS-307 70 MHz, IDS-310 100 MHz and IDS-320 200 MHz. The IDS-200 models offer memory depth of 1 Mpts/ch and a DMM count of 5000, whereas the IDS-300 models provide a memory depth of 5 Mpts/ch, a DMM count of 50,000 and temperature measurement.

The high-functionality devices weigh only 1.5 kg and are robust and portable around any worksite, providing easy measurement and fast data analysis. They are supplied with everything needed to get up and running as soon as possible, including: a 150 MHz probe for use with IDS-207/307/210/310 or a 250 MHz probe (for use with IDS-220/320); test lead; power cord; soft carrying case; soft carrying bag; AC-DC adapter; wrist strap; quick start guide; and CD user manual.

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### PXI source measure unit

National Instruments has announced the NI PXIe-4135 source measure unit (SMU) with a measurement sensitivity of 10 fA and voltage output up to 200 V. Engineers can use the device to measure low-current signals and take advantage of the high channel density, fast test throughput and flexibility for applications such as wafer-level parametric test, materials research and characterisation of low-current sensors and ICs.

Engineers can use the modular SMU to build parallel, high-channel-count systems in a compact form factor and benefit from up to 68 SMU channels in a single PXI chassis that can scale to hundreds of channels. Users can increase test throughput by taking advantage of a high-speed communication bus, deterministic hardware sequencing and a digital control loop technology to custom-tune the SMU response for any device under test. They can also control the SMU response through software, which removes long wait times for SMU settling and offers the flexibility to help minimise overshoot and oscillations.

The interactive soft front panels can be used for making basic measurements and debugging automated applications. The driver features help files, documentation and ready-to-run example programs to assist in test code development and includes a programming interface that works with a variety of development environments. Engineers can use the SMUs with NI's TestStand test management software, simplifying the creation and deployment of test systems in the lab or on the production floor.

**National Instruments Aust Pty Ltd**  
[www.ni.com/oceania](http://www.ni.com/oceania)

### Motor with gearhead

maxon motor has released the DC-max motor range fitted with the GPX gearhead. The motor offers the same high-powered rare earth magnets and patented maxon rhombic winding as the premium maxon motor range but is packaged in more cost-effective housing. Mixing technologies in this way enables the product designer to focus the gear motor's strengths where they are needed. The high motor speed and high gear reduction require the gearhead to act as an efficient transmission; this is achieved through precision machining and quality materials that the GPX gearhead offers.

The company has released an example gearmotor combination specified for a sample preparation application. The gearhead portion of the drive is exposed to a corrosive atmosphere, requiring all stainless steel construction; however, the motor portion is hermetically sealed and does not require the stainless steel body of the typical motor used with this gearhead. The advantage of this mix-and-match approach to gearmotor selection is that the mechatronic equipment designer can allocate costs where needed for the device.

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## High-sensitivity LCMS requires high-purity nitrogen carrier gas

To help instrument manufacturer Shimadzu select the right source of nitrogen for its liquid chromatography-mass spectrometry (LC-MS) analysis, BOC conducted a study to analyse nitrogen interference from cylinder, liquid bulk vessel and generator nitrogen sources. This was the first study of the effects of nitrogen source purity on advanced LC-MS equipment.

LC-MS requires nitrogen for drying, auxiliary and nebulising gas for analysis. Depending on equipment model and customer requirements, labs may employ nitrogen with varying purity levels from liquid bulk vessels, cylinders or in-house gas generators. As LC-MS equipment becomes increasingly sensitive with each new model, such as Shimadzu's LCMS-8060, it is essential to select the best nitrogen source to ensure optimal results.

"As sensitivity increases with each new LC-MS model, any impurity we discover in the background — such as water, solvents or polymers — will have an impact on our results," said Niron Van, business development manager, Shimadzu Australasia. "When using our in-house nitrogen generator with LC-MS 8060, we were seeing signal suppression — which reduces the sensitivity of results.

"BOC suggested we run these trials with their ultrahigh-purity (UHP), high-purity (HP) and liquid nitrogen products to eliminate the signal noise. Taking into account cost and equipment sensitivity levels, we found that liquid nitrogen from a bulk vessel was the best fit for our LC-MS 8060, as opposed to our in-house generator. We've since made the switch."

LC-MS is a powerful technique used to detect specific substances with very high sensitivity and selectivity. It is based on the analysis of ions that move through a series of vacuum stages until they reach the quadrupole, which separates the ions. The ions then travel to the detector where they are recorded as signals. When nitrogen with high levels of impurities is used as the carrier gas, it interferes with signal accuracy and reduces the sensitivity of the LC-MS process.

Hydrocarbon (methane), moisture and oil substances were the impurities of particular concern for Shimadzu. After isolating other potential causes of interference, Shimadzu partnered with BOC to examine other nitrogen gas sources to test for ion suppression, baseline disturbance and damaged o-rings in the calibrant delivery system (CDS).

Using standard water and methanol samples, BOC and Shimadzu compared nitrogen purity based on total positive ions counts (higher positive ion counts = higher total impurity) in four different nitrogen sources: UHP and HP from cylinders; liquid nitrogen from a bulk vessel; and Shimadzu's on-site generator.

Overall, the highest nitrogen purity came from the UHP nitrogen cylinder. Across all tests, the in-house generator had the highest levels of nitrogen impurity. Therefore, high-sensitivity equipment like the LCMS-8060 should use higher grades of nitrogen (UHP or HP from a cylinder, or liquid nitrogen from a bulk vessel) for more precise results.

As a result of the study, Shimadzu switched its carrier gas source for the LCMS-8060 from its in-house generator to liquid nitrogen from a bulk vessel, which has allowed the company to maximise the capabilities and sensitivity levels of the LCMS-8060.

"The switch to liquid nitrogen has shown a significant improvement and we're quite happy with the results," said Van. "The background is much cleaner, with an improved signal-to-noise ratio.

"This study really opened our eyes as to how much nitrogen source purity can interfere with our signals. We realised we have to increase our source purity as we develop newer equipment with higher sensitivity. In the future, we'll need to switch to ultrahigh-purity nitrogen sources, and now we know where to go."



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## ComBio

### October 3–7, Brisbane

ComBio2016 incorporates the annual meetings of the Australian Society for Biochemistry and Molecular Biology, the Australian Society of Plant Scientists and the Australia and New Zealand Society for Cell and Developmental Biology.

The conference will cover the following themes: plant cell and developmental biology and genetics; plant physiology and ecology; developmental, stem cell and regenerative biology; proteins and proteomics; genomes and bioinformatics; cell biology; cell signalling; biochemistry and metabolism; and education and career development.

[www.asbmb.org.au/combio2016/](http://www.asbmb.org.au/combio2016/)
**Reproductive Immunology**
August 17–20, Cairns  
[www.reproductiveimmunology2016.org](http://www.reproductiveimmunology2016.org)
**ESA Clinical Weekend**
August 19–21, Gold Coast  
[www.esaclinicalweekend.org.au](http://www.esaclinicalweekend.org.au)
**ESA-SRB-ANZBMS**
August 21–24, Gold Coast  
[www.esa-srb.org.au](http://www.esa-srb.org.au)
**ICI 2016**
August 21–26, Melbourne  
[www.ici2016.org/](http://www.ici2016.org/)
**ENSA**
August 22, Gold Coast  
[www.ensa.org.au](http://www.ensa.org.au)
**ADS-ADEA Roche Educators Day**
August 23, Gold Coast  
[www.ads-adea.org.au](http://www.ads-adea.org.au)
**ADS-ADEA**
August 24–26, Gold Coast  
[www.ads-adea.org.au](http://www.ads-adea.org.au)
**ASFB**
September 5–8, Hobart  
[www.asfb.org.au](http://www.asfb.org.au)
**Women in Science Australia — 2016 Symposium**

September 13–14, Melbourne  
[www.womeninscienceaust.org/national-symposium-save-the-dates/](http://www.womeninscienceaust.org/national-symposium-save-the-dates/)
**AACB AIMS 2016 Combined Scientific Meeting 2016**

September 13–15, Brisbane  
[www.aacb.asn.au/eventsinfo/aacb-aims-2016](http://www.aacb.asn.au/eventsinfo/aacb-aims-2016)
**AGITG**
September 13–16, Melbourne  
[www.agitg.org.au](http://www.agitg.org.au)
**APHIA Conference 2016**
September 14–16, Perth  
[www.aphia.org.au](http://www.aphia.org.au)
**International Congress of Tropical Medicine and Malaria 2016**

September 18–22, Brisbane  
[www.tropicalmedicine2016.com](http://www.tropicalmedicine2016.com)
**Bushfire 2016: Connecting Science, People & Practice**

September 28–30, Brisbane  
[www.fireandbiodiversity.org.au/bushfire-home](http://www.fireandbiodiversity.org.au/bushfire-home)
**ComBio2016**
October 3–7, Brisbane  
[www.asbmb.org.au/combio2016](http://www.asbmb.org.au/combio2016)
**AGTA**
October 9–12, Auckland  
[www.agtaconference.org](http://www.agtaconference.org)
**ANZOS**
October 15–17, Brisbane  
[www.anzos.com](http://www.anzos.com)
**AusBiotech 2016**
October 24–26, Melbourne  
[www.ausbiotechnc.org](http://www.ausbiotechnc.org)
**IBS 2016, the 17th International Biotechnology Symposium and Exhibition**

October 24–27, Melbourne  
[www.ibs2016.org](http://www.ibs2016.org)
**International BioFest 2016**
October 24–27, Melbourne  
[www.internationalbiofest.org](http://www.internationalbiofest.org)
**ABSANZ Conference 2016**
November 7–11, Melbourne  
[www.absanz.org.au](http://www.absanz.org.au)
**ASMR NSC**
November 13–16, Gold Coast  
[www.asmr-nsc.org.au](http://www.asmr-nsc.org.au)
**COSA-ANZBCTG**
November 14–17, Gold Coast  
[www.cosa2016.org](http://www.cosa2016.org)
**Lab Managers Conference 2016**
November 21–23, Brisbane  
[www.labmanagers.org.au](http://www.labmanagers.org.au)

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\* As of February 2016, based on data obtained by Shimadzu

