

Lab+Life SCIENTIST

A rustic still life featuring two glasses of beer with thick white foam, a loaf of bread, and stalks of barley on a wooden surface. The beer is golden and the foam is very thick and white. The bread is a rustic loaf, and the barley stalks are golden and dry. The background is a wooden surface with a natural grain.

Is your barley better for
bread or beer?

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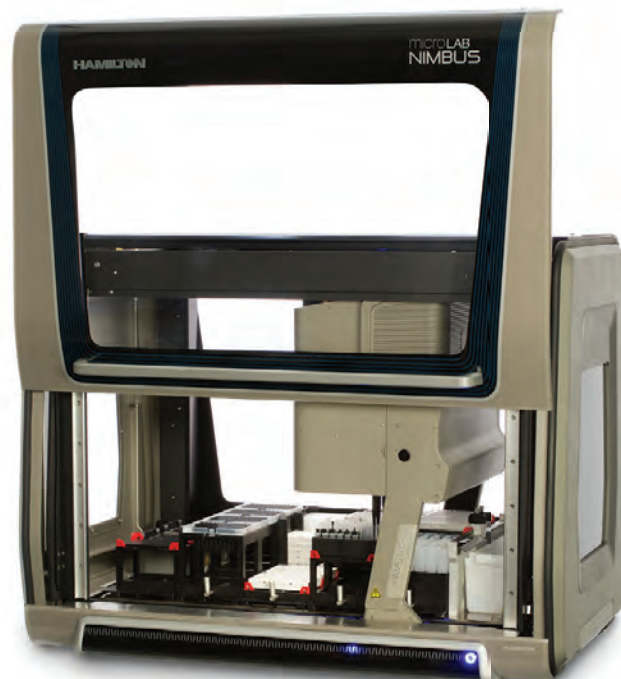
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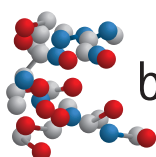
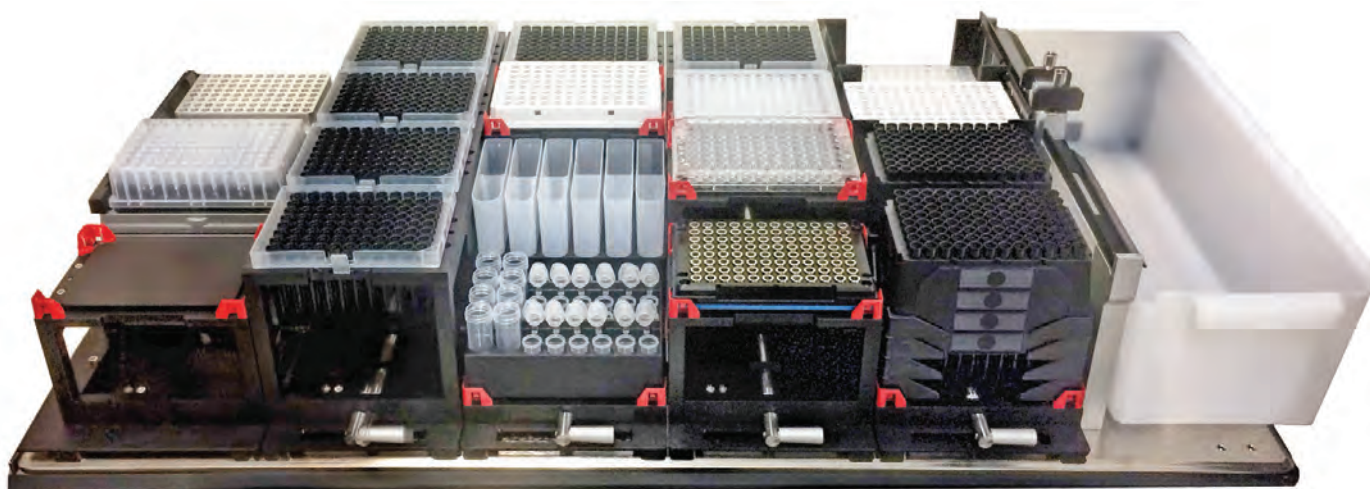
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Let's make 2017 the year of the scientist

We're only a few weeks into 2017 as I write this, and already so much has happened. Australia has just received its third Science Minister in as many years, bringing us even further away from those dark days of the Abbott government when the word 'Science' wasn't even mentioned in the portfolio title.

Yes, Arthur Sinodinos replaced Greg Hunt as Minister for Innovation, Industry and Science recently, and the reception from Australian science organisations has so far been optimistic.

"Minister Sinodinos brings a wealth of public policy experience to this portfolio that will help translate Australian research in areas such as medicine, clean energy and the basic physical and biological sciences into the economic growth that underpins a strong nation," said Professor Andrew Holmes, president of the Australian Academy of Science.

Kylie Walker, CEO of Science & Technology Australia (STA), added, "We look forward to long-term vision, support and consultation from Minister Sinodinos to ensure STEM professionals can fulfil their potential and ensure Australia's science and technology remains at the forefront internationally."

And just one week into his new role, Sinodinos found himself responding to the newly crowned Australian of the Year, Emeritus Professor Alan Mackay-Sim, who was honoured for his research applying the regenerative processes in the nose to treating spinal cord injury.

Accepting the award for his life's work, which played a significant part in restoring mobility

to a quadriplegic man back in 2014, Professor Mackay-Sim stated that "we must invest in our scientists and give them great careers", adding that "researchers need a long view — much longer than the political horizon".

The good news is that Sinodinos appeared to be listening, stating that the Australian of the Year is "right to remind us to take the long view when it comes to research and the need to invest in new treatments that reduce future health costs for all Australians".

"Professor Mackay-Sim inspires us to aim to be the best in the world in whatever field we can, and that is my aspiration for Australian industry, innovation and science," Sinodinos said.

"I am committed to building world-class careers for our young scientists and addressing the barriers to all Australians, regardless of background or gender, wanting to play a part in the future of scientific research in Australia," he added.

It's a bold statement to be making just one week into your new job, and I for one will be keeping an eye on our new Science Minister to see how closely he sticks to his word. But regardless of what Sinodinos goes on to say or do, he is certainly right in one respect — we should be using Professor Mackay-Sim's achievements as motivation to advance our own careers. Because while we can't all be Australian of the Year, that doesn't mean our work can't make a difference to the world.

To conclude, I would like to put forth the hypothesis that 2017 will be a great year for Australian science. Let's start testing whether I'm right, shall we?

Regards,
Lauren Davis
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Researchers from The Scripps Research Institute have revealed the role of protein synthesis in encoding long-term memories — specifically, memories associated with fear of a specific environmental cue.

Associate Professor Sathyanarayanan V Puthanveetil, who led the research, explained that his team was looking into a subtype of contextual memory — that is, the memory of an experience in a specific context. “For example, if you have an exciting experience in a specific office room or place, you tend to recall that experience whenever you visit that room or place,” he said.

“In the case of contextual fear memory, one associates a fearful experience with a specific context. Because contextual fear memories are long-lasting, scientists intensely study them to understand the mechanisms of memory storage and retrieval, as well as memory loss.”

Writing in the journal *Biological Psychiatry Cognitive Neuroscience and Neuroimaging*, Associate Professor Puthanveetil and his colleagues said they were investigating protein synthesis — a requisite for the consolidation and storage of long-term memories — in the area of the medial prefrontal cortex (mPFC) known in rodents as the prelimbic (PL) cortex and in humans as the anterior cortex, which has been linked to processing emotional responses. While previous studies had suggested that the mPFC plays an important role in the consolidation of long-term memories, it was unknown whether it also played a role in encoding these memories.

The researchers sought to answer this question by employing contextual fear conditioning (CFC) in rodents, whereby an adult mouse would be put inside a fear-conditioning chamber and given three mild foot shocks. Associate Professor Puthanveetil explained, “The mice associate the memory of the foot shocks to the fear-conditioning chamber and exhibit a freezing behaviour in response to foot shocks.

“The next day, the mouse is put back into the fear-conditioning chamber and the animal will show freezing behaviour in the absence of foot shocks,”

Making memories





Because contextual fear memories are long-lasting, scientists intensely study them to understand the mechanisms of memory storage and retrieval, as well as memory loss.

Associate Professor Puthanveetil continued. “This is because the mouse associates the foot shock experience to the fear-conditioning chamber.”

Following this contextual fear conditioning, the scientists imaged the mice’s brains in order to assess the changes in polyribosome-associated messenger RNAs (mRNAs) in the mPFC. “We identified several mRNAs that are differentially and temporally recruited to polyribosomes in the mPFC,” they said — a clear indication that this was where protein synthesis had taken place.

The researchers then went one step further, injecting the mice with an inhibitor called anisomycin (ANI) that would block new protein synthesis in the PL cortex. After injecting the mice immediately post-fear conditioning, then testing them 24 hours later, it was clear that the mice were no longer freezing once entering the fear-conditioning chamber — the memories had thus not taken hold.

But the researchers weren’t done yet, as they now wondered whether continuous protein synthesis in the PL cortex is required for encoding contextual fear memory. So rather than injecting the inhibitor straight away, the researchers waited until six hours after CFC training. The mice’s responses were now comparable to that of the placebo group, indicating that mPFC protein synthesis was only required for encoding in the immediate aftermath of the fear conditioning.

“There is [therefore] a specific time window during encoding that is sensitive to the disruption of protein synthesis in the PL cortex,” the scientists said.

Finally, the researchers analysed the expression of the protein Homer3, which is located in the PL cortex and whose mRNAs were found to be enriched in polyribosomes within the first hour following CFC training. “This suggested that Homer3 was produced in response to the training and therefore Homer3 plays a critical role in contextual fear memory storage,” Associate Professor Puthanveetil said.

Seeking to study the consequences of reducing Homer3 protein levels in neurons, the scientists injected ANI into the PL cortex, confirming that the

inhibitor caused a significant decrease in Homer3 mRNA loaded onto polyribosomes. Next, they knocked down Homer3 mRNA in the PL cortex using small interfering RNAs (siRNAs). When tested 24 hours after training with CFC, mice injected with Homer3 siRNA exhibited reduced fear compared with the control group.

“We found that more of Homer3 proteins are produced during contextual fear memory storage and that reduction in Homer3 protein levels in neurons impedes formation of fear memory,” Associate Professor Puthanveetil said. “Thus, Homer3 has a critical role in contextual fear memory storage.”

The scientists had succeeded in identifying several molecular substrates of new protein synthesis in the mPFC and established that encoding of contextual fear memories requires new protein synthesis in the PL subregion of the mPFC. They therefore concluded that, in addition to the mPFC’s role in long-term memory storage, it also has an early role in memory consolidation and encoding contextual fear memories.

“This is very important and exciting because despite our understanding that production of new proteins is critical for memory storage, very few of newly produced proteins are known,” said Associate Professor Puthanveetil.

The researchers added that it remains to be determined if other subregions of the cortex are also involved in the synthesis of memory proteins. As noted by study co-author Bindu L Raveendra, “The specific roles of these subregions in encoding, expression and retrieval, as well as their underlying molecular mechanisms, remain to be unravelled.”

Sathyanarayanan V Puthanveetil is an associate professor at The Scripps Research Institute. Photo by James McEntee.





Australia's antibacterial honey

Researchers have found that the nectar-derived chemical that gives New Zealand's manuka honey its apparently unique antibacterial properties is also present in Australian varieties. Published in the journal *PLOS ONE*, their study provides hope for clinicians seeking treatment for antibiotic-resistant skin infections as well as chronic and acute wounds.

Honey has been used therapeutically for hundreds of years, with different varieties containing different medicinal properties depending on the flowers bees visit for nectar. As explained by Dr Nural Cokcetin from UTS's ithree institute, "What makes manuka honey so special is the exceptionally high level of stable antibacterial activity that arises from a naturally occurring compound in the nectar of manuka flowers. It's the ingredient we know acts against golden staph and other superbugs resistant to current antibiotics."

The compound in question, methylglyoxal (MGO), has already been found to act against golden staph and other superbugs resistant to current antibiotics. As noted by Professor Liz Harry, director of the ithree institute and lead investigator on the project, "Honey not only kills bacteria on contact, but we have shown previously that bacteria don't become resistant to honey."

New Zealand is the world's primary source of medicinal honey, but the country grows only one species of manuka (*Leptospermum*) tree, and its honeybee population is threatened by the parasitic varroa mite. Australia, meanwhile, is home to 83 of the 87 known *Leptospermum* species and is still free of the varroa mite. But just how powerful are our honey's antibacterial properties?

In a collaboration which also involved the University of Sydney and the University of the Sunshine Coast, Professor Harry's team studied more than 80 honey samples from NSW- and Queensland-flowering *Leptospermum* trees. Dr Cokcetin said, "Our study provides the proof for what we've long assumed — that ... MGO is present in high levels in Australian manuka honeys."

"We've also shown that the activity of Australian manuka honeys has remained unchanged over seven years from harvest, which has huge implications for extending the shelf life of medicinal honey products."

Dr Cokcetin said the study will "put Australian manuka honey on the international radar at a time when antibiotic resistance is recognised as a global crisis", offering new opportunities for Australia's 12,400 registered beekeepers and 200,000 commercial hives.

Mosquitoes genetically engineered to resist dengue

After decades of research and countless control attempts, US scientists have successfully engineered mosquitoes that have an increased resistance to infection by dengue fever.

When a mosquito bites someone infected with dengue virus (DENV), the virus needs to complete its life cycle in the mosquito's gut, eventually infecting its salivary glands, before it can infect another person. Previous studies have shown that mosquitoes rely on a molecular pathway dubbed JAK/STAT to try to fight DENV infection and stop this cycle. Proteins known as Dome and Hop are involved in turning on the JAK/STAT when the mosquito is infected with DENV.

Scientists at Johns Hopkins University, led by George Dimopoulos, genetically engineered *Aedes aegypti* mosquitoes to turn on expression of either Dome or Hop in the fat body tissue, earlier in infection — immediately after ingesting blood — and make more of the proteins. The results were published in the *PLOS Neglected Tropical Diseases*.

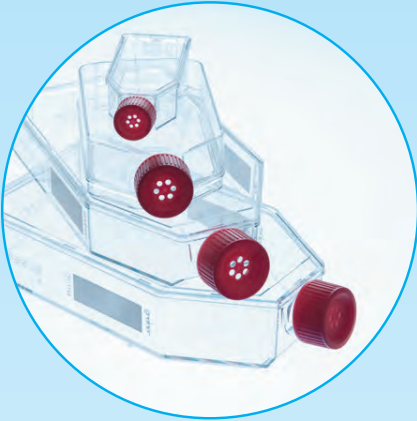
Mosquitoes with engineered versions of Dome or Hop that were then infected with DENV had 78.18% (Dome) and 83.63% (Hop) fewer copies of the virus in their guts, as well as significantly less virus in their salivary glands. Mosquitoes with the altered genes had normal life spans, but produced fewer eggs than normal mosquitoes. When the researchers repeated the experiments with Zika virus and chikungunya virus, no impact was seen on infection, suggesting that the importance of the JAK/STAT pathway in the fat body tissue is unique to DENV.

"It may be possible to achieve improved or total resistance to dengue and other viruses by expressing additional transgenes in multiple tissues that block the virus through different mechanisms, and/or by using more effective promoters," the researchers concluded. "Recently developed powerful mosquito gene-drive systems, used circumspectly, are likely to make it possible to spread pathogen resistance in mosquito populations in a self-propagating fashion, even at a certain fitness cost."



The Power of Science

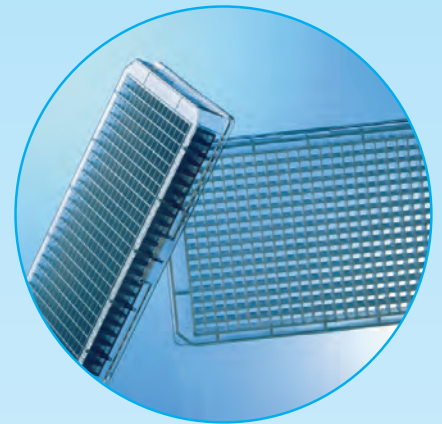
Cell Culture



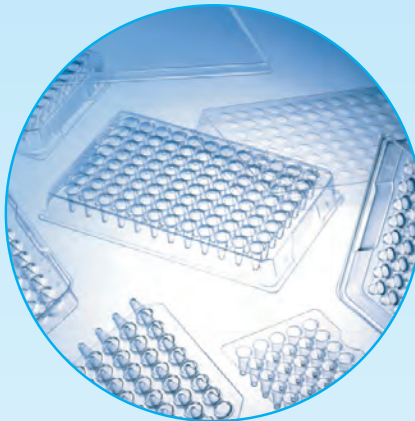
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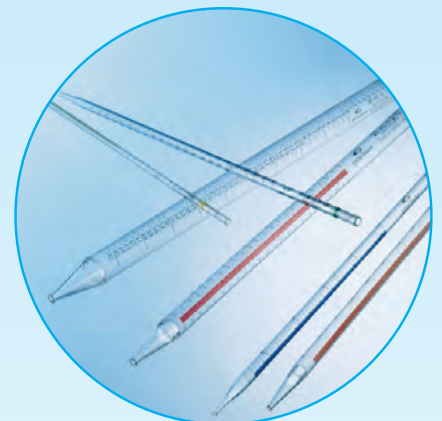
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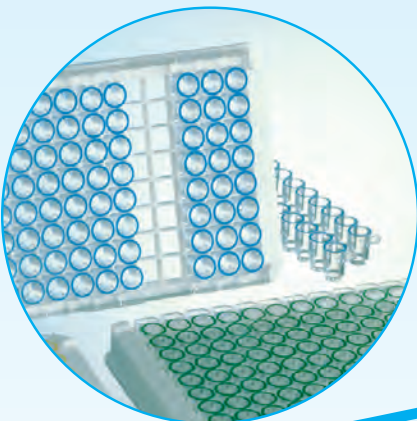
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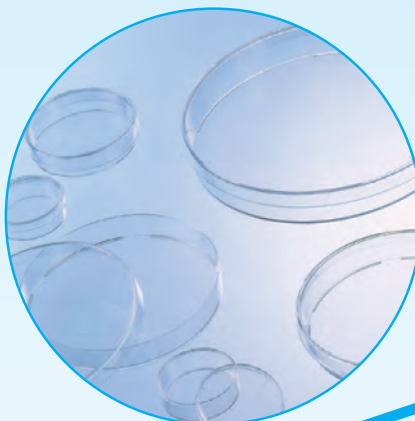
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An eye test for Alzheimer's

Researchers at Macquarie University and Edith Cowan University (ECU) will be the first in NSW and Western Australia, respectively, to have access to a retinal-scanning camera that can identify beta-amyloids, known to be an indicator of Alzheimer's disease.

The current gold standard for identifying biological markers of Alzheimer's disease includes positron emission tomography (PET) for brain amyloid imaging and cerebrospinal fluid (CSF) analysis. Both PET amyloid imaging and CSF analysis can detect Alzheimer's disease 15–20 years before clinical onset. However, these approaches are expensive, invasive and not widely available, which precludes them from routine clinical use — hence the need for alternative screening options.

"There is a real demand within the community for it to be possible to detect Alzheimer's early, and in a relatively simple, non-invasive way," said Ralph Martins, Professor of Neurobiology at Macquarie University and Foundation Professor of Ageing and Alzheimer's disease at ECU.

"We need a reliable, and more readily accessible, sensitive biological marker to make early diagnosis possible in order for therapeutic interventions to be effective."

Using a hyperspectral camera from Optina, Professor Martins and his retinal imaging team will work to develop a simple eye test for Alzheimer's screening within the population. The NASA-inspired technology allows localisation of structures and biological molecules in the retina using their specific spectral signatures — a feature that is currently not available in other commercial retinal cameras.

"Having access to these cameras gives us the real potential to explore the identification of a protein in the brain called beta-amyloid, known to be linked to Alzheimer's, that can be viewed in the eye well before the onset of memory impairment," explained Professor Martins.

Professor Martins said the camera could identify other disorders, such as age-related macular degeneration, glaucoma, diabetic retinopathy. It could also have applications in the monitoring of patient response to new and future therapies.

The enzyme that helps us fight the flu

Deakin University scientists have found that the human body could naturally hold the key to a speedy recovery from the flu.

The research was conducted by a team led by Associate Professor John Stambas, who explained, "The flu shot offers very good protection against seasonal virus strains; however, mismatches between the circulating strain and the vaccine occur from time to time, leading to a reduction in its efficacy."

"That's why our research focuses on the host, finding a way for humans to harness an enzyme they already possess to fight back and clear the virus quickly."

In a series of experiments, the results of which were published in the journal *PLOS Biology*, the researchers showed that mice lacking the ability to express an enzyme known as ADAMTS5 showed increased signs of disease when compared to normal control mice.

"We believe this is due to the fact that the ADAMTS5 enzyme is not degrading its target protein substrate (versican) efficiently, making it difficult for immune cells to move and clear the virus," Associate Professor Stambas said.

"We find that a subset of white blood cells involved in clearing infection gets trapped in the lymph node closest to the lung. As a result, mice have higher levels of virus in their lungs, lose more weight and their immune responses are impaired."

The researchers' next step, according to Associate Professor Stambas, will be "testing if we can administer or express higher levels of ADAMTS5 to help speed up cell movement and improve immunity to viruses".

"Hopefully this will add another option to the arsenal in our fight against the flu," he said.



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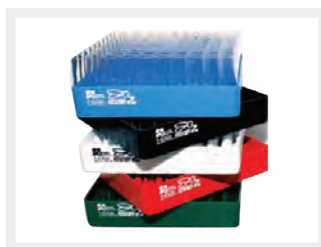
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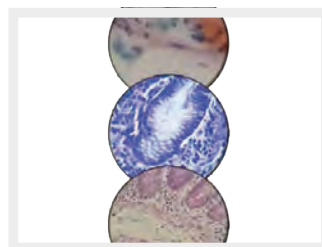
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Image: An artist's impression of the Spiderweb galaxy sitting in a cloud of cold gas (blue). Modified by CSIRO from ESO. ©ESO/M Kornmesser under CC BY 4.0

Giant galaxies may grow from cold gas

Giant galaxies may grow from cold gas that condenses as stars, according to an international research team, contradicting the theory that they are formed by smaller galaxies falling together in a hot, violent merger.

The news was announced in the journal *Science* by researchers led by Dr Bjorn Emonts, from the Centro de Astrobiología in Spain, who saw something very strange when they looked at a protocluster 10 billion light-years away. This protocluster was known to have a giant galaxy called the Spiderweb forming at its centre.

Dr Emonts' team found that the Spiderweb is wallowing in a huge cloud of very cold gas that could be up to 100 billion times the mass of Earth's Sun. Most of this gas must be hydrogen, the basic material from which stars and galaxies form.

The astronomers located the hydrogen gas by detecting a tracer gas, carbon monoxide (CO), which is easier to find. The Very Large Array telescope in the US showed that most of the CO could not be in the small galaxies in the protocluster, while CSIRO's Australia Telescope Compact Array saw the large cloud surrounding the galaxies.

Earlier work by another team had revealed young stars all across the protocluster. The new finding suggests that, rather than forming from infalling galaxies, the Spiderweb may be condensing directly out of the gas, according to team member Professor Ray Norris from CSIRO and Western Sydney University.

Co-author Professor Matthew Lehnert, from the Institut Astrophysique de Paris, described the gas as "shockingly cold" — about -200°C .

"We expected a fiery process — lots of galaxies falling in and heating gas up," he said.

As for where the carbon monoxide came from, that's still a mystery.

"It's a by-product of previous stars, but we cannot say for sure where it came from or how it accumulated in the cluster core," Dr Emonts said.

"To find out, we'd have to look even deeper into the universe's history."

Clay nanoparticles provide chemical-free crop protection

Researchers from The University of Queensland (UQ) have found that by combining clay nanoparticles with designer RNAs, it is possible to silence certain genes within plants. Their 'BioClay' technology provides a crop protection technique that is environmentally friendly, sustainable and, most importantly, effective.

"In agriculture, the need for new control agents grows each year, driven by demand for greater production, the effects of climate change, community and regulatory demands, and toxicity and pesticide resistance," said research leader and study co-author Professor Neena Mitter.

"Our disruptive research involves a spray of nanosized degradable clay used to release double-stranded RNA that protects plants from specific disease-causing pathogens."

Based on nanoparticles used in the development of human drug treatments, the technology reduces the use of pesticides without altering the genome of the plants. Professor Mitter explained, "Once BioClay is applied, the plant 'thinks' it is being attacked by a disease or pest insect and responds by protecting itself from the targeted pest or disease."

BioClay has a number of advantages over existing chemical-based pesticides. By loading the agents onto clay nanoparticles, they do not wash off, enabling them to be released over an extended period of time before degrading. The technology is also non-toxic and can be used in a highly targeted way to protect crops against specific pathogens.

"A single spray of BioClay protects the plant and then degrades, reducing the risk to the environment or human health," said Professor Mitter.

Professor Mitter said BioClay meets consumer demands for sustainable crop protection and residue-free produce, with the cleaner approach expected to value-add to the food and agribusiness industry. Study co-author Professor Zhi Ping Xu added that the technology's applications "expand into a much wider field of primary agricultural production".

The project was supported by a Queensland Government Accelerate Partnership grant and a partnership with chemical company Nufarm. It has been published in the journal *Nature Plants*.



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Upstream bioprocessing platform

Sartorius Stedim Biotech (SSB) has developed an innovative and fully integrated technology platform to meet the requirements of today's upstream bioprocessing. Connect Upstream combines a high-performing expression system with equipment and process control for the rapid development and scale-up of robust, high-titre commercial manufacturing processes. The company claims that biopharmaceutical manufacturers will be able to reach the clinic in 14 months by leveraging the platform.

The royalty-free CHO expression platform of SSB subsidiary Cellca delivers the titres required to meet companies' cost-of-goods objectives. Cellca can establish a research cell bank for its clients within just four months. The automated ambr15 micro bioreactor system is capable of controlling 24 or 48 micro bioreactor experiments.

The system accelerates clone selection and scales up readily to BIOSTAT STR single-use bioreactors, which biomanufacturers have successfully implemented at pilot and GMP production scales. To reduce early-stage development

timelines still further, Sartorius Stedim Biotech has integrated more than 100 off-the-shelf and prequalified assays from BioOutsource into its platform, allowing the rapid testing and analysis of biosimilar products.

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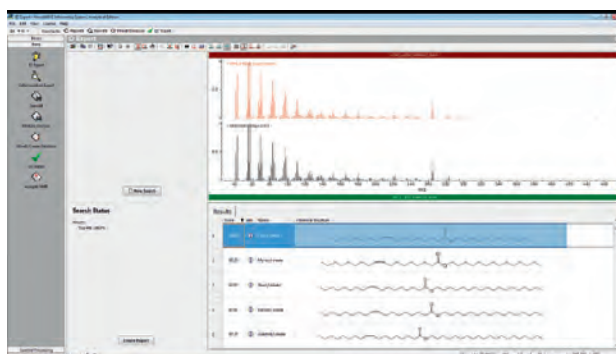
Spectroscopy software

Bio-Rad Laboratories has announced the release of its KnowItAll 2017 spectroscopy software and databases. The release offers an additional 976,000 reference spectra in the KnowItAll Spectral Library, including Bio-Rad's Sadtler spectra as well as spectra from John Wiley & Sons, bringing the spectral database collection to over 2.3 million spectra.

The software offers comprehensive solutions for spectral analysis, identification, search, data management and reporting. Bio-Rad's KnowItAll ID Expert software application for spectral identification supports all techniques in the software (IR, Raman, NIR, NMR, MS, UV-Vis).

Users can now save time by automatically importing structures and properties directly from PubChem to enhance user-built databases. Improvements have also been made to streamline the company's Enterprise Server software for management of spectral and chemical data throughout an organisation.

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Confocal laser scanning microscope

Designed to meet some of the most difficult challenges in modern science, Olympus has announced the launch of the FLUOVIEW FV3000 confocal laser scanning microscope. Built for fast, stable imaging of biological processes within living cells and tissues, the product offers the flexibility required for live cell imaging, high-resolution fixed imaging and the temporal resolution required to image dynamic intracellular processes.

Succeeding the FV1200, the FV3000 is controlled via an intuitive software interface so even novice users can generate high-quality data and images. The system's optical design offers macro to micro imaging capabilities with objectives ranging from 1.25x to 150x magnification. The broad magnification range allows a diverse range of biological samples to be imaged at biologically relevant resolutions.

The addition of Olympus's silicon oil-immersion objectives enables imaging of live specimens over long time periods. The use of silicon oil immersion allows users to generate bright, high-resolution images with less spherical aberration due to the refractive index match between silicon and cells immersion media.

The FV3000 is available in two standard configurations: a galvanometer-only scanner and the FV3000RS with both a resonance scanner and a galvanometer scanner. The addition of a resonance scanner allows imaging of high-speed processes up to 438 fps.

Olympus Australia Pty Ltd
www.olympusaustralia.com.au

Filtration units

Merck's EZ-Fit Filtration Units for microbial enumeration are stackable to save on laboratory space. Users can choose from a wide selection of membranes and have the flexibility to use the units with solid or liquid media.

The drain design provides a good contact with agar when transferring the membrane, and the base protective rim prevents cross-contamination. Filtration time is reduced on difficult-to-filter samples due to the base design and set-up time.

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Characterising nanomaterials in commercial products

LGC, an international life sciences measurement and testing company, has been using Postnova Analytics' AF2000 field-flow fractionation (FFF) system coupled to inductively coupled plasma mass spectrometry (ICP-MS) to characterise nanomaterials in complex sample matrices for clinical, cosmetic and food use.

With nanomaterials present in over 1300 commercial products, it is important to be able to characterise nanomaterials to understand their behaviour in contact with humans and the environment. The inorganic analysis team at LGC has expertise in size-based and number concentration analysis of nanomaterials using hyphenated techniques to support the development of reference methods and materials, with FFF coupled to ICP-MS (FFF-ICP-MS) being the centrepiece of their multimodal analytical approach.



"Over the last 15 years, field-flow fractionation (FFF) coupled to ICP-MS and other sizing detectors has proven itself a powerful tool for the characterisation of nanomaterials," said LGC Principal Scientist Dr Heidi Goenaga-Infante. "For complex samples FFF seemed the ideal choice for matrix separation/sample fractionation, enabling us to achieve selective detection and characterisation of nanomaterials that otherwise would have been hampered by the matrix components."

The team recently utilised FFF-ICP-MS for the development of a methodology for the determination of number-based concentration of silica nanoparticles with a diameter of

approximately 80 nm in a complex serum sample. Their work made use of the AF2000 — a high-performance FFF platform for separation of proteins, macromolecules and nanoparticles — from Postnova Analytics.

"We selected Postnova Analytics as our vendor of choice on the basis of their fast response to queries, scientific credibility and knowledgeable technical research assistance," said Dr Goenaga-Infante.

By itself, single-particle ICP-MS failed to detect silica nanoparticles due to the high procedural blank for Si with the instrumentation available at the time. In addition, particle tracking analysis (PTA) failed to provide accurate number concentration data with a reasonable measurement uncertainty due to matrix interferences. By using flow FFF to separate the particles from the matrix with online PTA detection, LGC was able to determine number-based concentration for silica nanoparticles of $d < 100$ nm in a complex biological matrix, with no requirement for chemical pre-treatment.

"The Postnova AF2000 system works robustly online when coupled with ICP-MS if a systematic approach is undertaken," said Dr Goenaga-Infante. "We very much look forward to extending this collaboration into a partnership for life."

Scientex Pty Ltd
www.scientex.com.au

Multi-experiment workstation

Many laboratories are short of space due to individual set-ups such as stirring hotplates, water baths and heating mantles, each requiring their own electrics, gas and cooling water supply. The StarFish Multi-Experiment Work Station, from Radleys, is a space-saving product that is said to make users' lives easier and improve productivity.

Using existing laboratory stirring hotplates and glassware, the small footprint can be configured to perform complex procedures in parallel. These include synthesis, extraction, concentration and distillation.

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





Automated sample management system

Hamilton Storage introduces SAM HD, a low-capacity automated sample management system. The product is a walkaway solution for labs seeking to transition from manual to automated sample storage.

The system can process samples through the day or outside of typical work hours to maximise productivity throughout the lab. Models are available for storing samples at +4°C, -20°C, -40°C and -80°C, with capacity up to 60,000 tubes in standard racks or 86,250 tubes using the company's SBS-compliant, high-density RackWare racks.

The product is easily programmed, including chain-of-custody permissions, via a user-friendly touch-screen PC monitor with INSTINCT S software. This integrated software is standard across all Hamilton Storage platforms, compatible with Microsoft Windows 10 and integrates with LIMS systems.

Up to six different tubes with the same diameter may be stored together to accommodate varying sample collection workflows while maintaining secure sample documentation and tracking. This variety of labware can also be picked without the hassle of tooling changes and without compromising the integrity of unpicked samples. A high-quality camera provides a wide field of view to save time during picking.

The system is suitable for automated sample storage in biobanking, forensics, drug discovery, life science, pharmacogenomics and more.

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From bread to beer

the gene mutation in barley

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A research team led by Okayama University has discovered the gene mutation and enzyme that determine whether the dormancy of barley is long (better for food crops) or short (better for beer-making). Their results have been published in the journal *Nature Communications*.



The effects of *qsd1* (left) and *Qsd1* (right) alleles on seed germination after five weeks of 25°C dormancy reduction treatment.

Wild barley is characterised by long grain dormancy, which lasts for several months after grain maturation. This dormancy means that, initially, the grain will not germinate in response to transient moisture availability and will therefore survive hot, dry summers.

But while barley with long dormancy is ideal for the production of food crops, it is undesirable when malting barley kernels for brewing beer or distilling whisky, as seeds with long dormancy will by association require a long storage period prior to malting. Beverage producers are thus more inclined towards barley with short dormancy times.

Seeking to investigate the control of dormancy by the food and beverage industry, researchers from Okayama University, Japan's National Institute of Agrobiological Sciences and the University of Adelaide compared DNA sequences of Haruna Nijo — a type of barley known to have short dormancy — with wild barley H602, known to have long dormancy. Haruna Nijo has a dominant short-dormancy allele called *Qsd1*, whereas H602 has a recessive long-dormancy allele called *qsd1*.

"The *qsd1* gene for long dormancy appears to be a mutable gene that might be used for adaptation to different environments and this is consistent with the large variation in *qsd1* sequence that exists in nature," the researchers wrote.

"For example, the long dormancy *qsd1* gene could be used to control pre-harvest sprouting in

higher rainfall areas to enhance global adaptation of barley. On the other hand, certain haplotypes which carry the *Qsd1* mutation are associated with barley lines that have been developed for industrial uses, such as in the malting and brewing industries."

But what enabled the emergence of the *Qsd1* mutation in the first place? After studying over 5000 plants, the researchers identified the section of the barley's DNA that varies with expression of long or short dormancy — the gene AK372829.

AK372829 codes the enzyme alanine aminotransferase (AlaAT), which is known to play a pivotal role in nitrogen and carbon pathways and protein synthesis and has been implicated in stress responses to low oxygen and nitrogen availability. It has not, however, been linked with dormancy in plants — not until now, that is.

"We show that a single amino acid substitution in this enzyme reduces the dormancy period of mature barley grain," the researchers wrote.

The researchers concluded that Haruna Nijo shares ancestry with long-dormancy, food-producing barley, suggesting "specific selection of reduced dormancy for the malting process". They added that the selection and exploitation of plants expressing the *Qsd1* mutation for short dormancy "contributes further to the debate as to what extent the development of ancient agrarian societies was driven by the human appetite for flour and bread, or for beer and alcohol".

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Laboratory balance for manual pipette calibration

The Sartorius Cubis MPS is a laboratory balance designed to reconcile the user's needs for accuracy, precision, speed and convenience in pipette calibration. The embedded sensors and dedicated climate control tower constantly monitor the temperature, humidity and barometric pressure inside the weighing chamber, as well as the calibration medium and the surrounding lab environment.

In between pipetting steps, the motion-controlled draft shield sliding door on the evaporation trap lid opens and closes automatically. The humidity level is safely maintained within the weighing chamber. As a result, the user can perform the next measurement instantly.

The innovative technology of the built-in motion control sensor monitors the area around the weighing chamber at a 180° angle. It detects a pipette at all times, no matter if it approaches from the left, right or the front.

The product is available in a choice of two pipette calibration balance modules, for the calibration of single-channel pipettes with volumes from 1 to 10 μL (weighing capacity 6.1 g, readability 0.001 mg) and 10 to 100 μL (weighing capacity 100 g, readability 0.01 mg).

Sartorius Stedim Australia Pty Ltd

www.sartorius.com

Disposable pipette tip

Tecan is simplifying handling of biological fluids with the introduction of a wide bore version of its 1000 μL Liquid Handling Arm (LiHa) disposable tip. Initially available for use with the Air LiHa air displacement pipetting option on Freedom EVO workstations, the filtered tip has been developed to help alleviate some of the issues associated with handling complex liquids for applications such as biobanking and clinical diagnostics.

The wide bore tip option is aimed at users routinely working with viscous or non-homogenous biological fluids. Supplied in Tecan Pure purity in the company's hanging tray format, the larger diameter aperture of the tip should help to eliminate tip occlusion errors, reducing the need for manual intervention and improving laboratory productivity.

The tip is currently supported for capacitive liquid level detection (cLLD) and Pressure Monitored Pipetting (PMP) in the latest version of Freedom EVOware and will soon be available for use with both the Freedom EVO's liquid-displacement LiHa and the Fluent Laboratory Automation Solution's Flexible Channel Arm, allowing it to be easily introduced into existing workflows.

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Automated sample preparation system

The Biotage Extrahera is a powerful, user-friendly, automated sample preparation system capable of processing both plate or column formats.

The compact, 8-channel instrument is designed for speed, flexibility and ease of use. It is designed for use with supported liquid extraction (SLE), solid-phase extraction (SPE), phospholipid depletion (PLD) and protein precipitation (PPT) methods.

Shimadzu Scientific Instruments (Oceania) Pty Ltd

www.shimadzu.com.au

Mixed-mode selectivities and particle sizes for columns

Phenomenex has introduced mixed-mode selectivities and particle sizes for UHPLC, HPLC and preparative work in the Luna column family.

The Luna Omega Polar C18 stationary phase delivers a wide elution window and combined high retention for polar and non-polar analytes. The phase is 100% aqueous-stable due to a polar-modified surface, providing flexibility in solvent and gradient system selection needed to achieve desired polar/non-polar analyte separation. It is offered in a high-performance 1.6 μm particle for UHPLC instruments as well as a low-pressure 5 μm particle for direct scalability to analytical HPLC or preparative work. The 5 μm particle is available in Phenomenex's Axia-packed preparative columns.

The company is also introducing the 100% aqueous-stable Luna Omega PS C18, which delivers two distinct separation mechanisms at the same time. The particle surface of the PS C18 contains a positive charge that facilitates greater acidic compound retention through ionic interaction, while the C18 ligand delivers general reversed-phase retention. This mixed-mode selectivity is a valuable tool for greater separation between mixtures of compounds that have varying functional groups, such as peptides, pesticides or metabolite profiles. Additionally, the positive surface charge encourages good basic compound peak shape through the ionic repulsion of these compound species.

Luna Omega columns are suitable for a wide range of applications, including drug discovery and development, food contaminant analysis, environmental testing, toxicology and clinical research.

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Lean laboratories

The prerequisite to survive rising pressure to deliver?

Lean principles offer laboratories a chance to revitalise services for the age of genomics and personalised care. Dr Gene Elliott* explores how decades-old car manufacturing ideas could now help laboratories support better patient outcomes, lower costs and meet hugely rising demand.

Patients' expectations of health care are rising. An endless evolution of social and digital media is driving greater public awareness of new technology and treatment options either now or imminently available.

The possibilities for patient engagement on social media coupled with free-flowing information are unprecedented, so clinicians and healthcare workers are faced with new service delivery demands from an increasingly complex landscape of rising co-morbidities and better informed customers.

Laboratories are certainly feeling the knock-on resulting pressures. Healthcare growth areas range from genetic profiles through to new techniques in screening for diseases and monitoring chronic conditions, point-of-care and personal device testing, and each one invariably depends on some form of supportive traditional laboratory testing.

The number of stakeholders who now have an interest in the services offered also challenges laboratories. These may include healthcare workers, payers, institutions, environmental agencies and increasingly, patients wanting ownership of their information by accessing their results as part of personalised medicine.



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To meet the shifting demand in work type and service, laboratories have had to adapt and become more efficient. At the same time, funding models have changed to emphasise patient benefit and better outcomes over traditional models of fee for service. There is a pressing need for operational efficiency that must be met despite challenges that include shrinking funding, escalating input costs and pressure on existing resources.

The convergence of all these factors has made managing a laboratory extremely complex with legacy laboratory information management systems (LIMS). Sophisticated information systems are now needed to support the logistics,

measurement, planning and analytics involved to avoid overburdening staff with manual processes.

Laboratory consolidation is not the only way to cut costs

Healthcare systems across the world are pursuing consolidation strategies to improve efficiency. In the UK, the February 2016 Carter Report confirmed that consolidated pathology services first recommended in a 2008 review were now the most efficient pathology organisations anywhere in the English National Health Service. New technologies and scalable operations have resulted in a significant savings to the NHS while quality has been maintained or improved.

Beyond consolidation, even greater efficiency gains are possible with an ongoing improvement program. Transforming laboratories into an agile and responsive pathology service capable of continuous improvement, however, requires new-generation software that captures and delivers real-time relevant information in a manner that supports a responsive evidence-based decision-making at the coalface.

Health care has generally been slow to adopt the techniques that have improved quality and safety in other industries. Many claim that medicine is too different and too complicated — that advances in other industries are not applicable to the care of patients. Others argue that the prevalence of medical errors and a lack of processes — often only exposed by litigation — mandate that changes be made.

Lean principles can revitalise laboratory services

Recently, there has been a surge in the number of healthcare initiatives utilising lean principles that centre on continuous improvement but maintain respect for the rights of individual consumers. These aim to address service and quality issues while containing healthcare costs that have been spiralling upwards at levels above inflation in almost every country.

Some laboratories have adopted lean principles in response to increased demand. Lean, originally

developed in car manufacturing, is a systematic approach to process improvement. It focuses on reduction of variations and elimination of waste, aiming to balance the process or workflow. In the laboratory, focusing on lean principles creates an opportunity to revitalise processes, streamline workflows and improve service delivery.

Lean adoption brings its own challenges. Significant change faces inevitable resistance, as people fear losing their jobs or not coping with new requirements, and can be difficult to manage. Challenging preconceived and embedded beliefs about laboratory work requires uncomfortable critical thinking about the actual value to the customer of many routine or historically accepted tasks.

Determining the real value of each action allows development of the most suitable protocols to achieve the desired outcomes. You can design a process from end to end to optimise each step, taking advantage of automated platforms and parallel tracks to enable sorting and workload allocation. Standardising processes reduces variation in outcomes and allows comparison and benchmarking across sites to continually improve efficiency.

Overcoming resistance with evidence

Lean initiatives can only overcome resistance to change and go on to deliver continuous improvement, however, with evidence that they work. This is now practical with modern information systems. Laboratories can monitor compliance with procedure and process, capture and analyse data to produce useful information and provide the knowledge required to make better decisions both in real time and for strategic planning.

When improvements in turnaround times, costs and the quality of test results are all captured, then enhanced operational performance can actually be proven. Better quality of results also improves safety for patients and employees. The reduction of errors and faulty results reduces retesting, reducing costs, and minimises wastage of reagents and manpower.

Quantifying waste reduction associated with lean processes and gauging the impact, however, requires built-in measurement of individual performance indicators and cost drivers. Accurate measurement proves to management and funders that the laboratory is more efficient and effective and benefit of interventions is quantifiable. Management dashboards that monitor real-time data relevant to the laboratory's operational function and performance, and are flexible enough to enable responsive planning, also support more agile responses to changing circumstances.

Quantifying the actual cost, both fixed and variable, to perform tests enables better utilisation of resources and available budget. Managing stock for just-in-time ordering and reducing reagent costs contributes to lower overheads. Software that captures and reveals each cost supports day-to-day management of processes and facilitates planning and budgeting. Understanding the volume of tests and expected demand allows logistic planning and staff management. Most legacy LIMS today do not have these capabilities.

Going beyond LIMS

Demands to measure and understand performance are necessitating a new breed of system, which InterSystems calls a laboratory business management system (LBMS). New-generation IT platforms that support the operational input

requirements of laboratory processes and make the data visible via dashboards and easy-to-use analytics are essential for the local management teams to implement lean principles. Service-level agreements continue to demand improvements and require governance and robust technology support of systems designed to demonstrate compliance with the improvement cycle.

Following standardisation of existing processes laboratories can reduce development times for new tests and streamline their implementation process. The laboratory can quickly increase its repertoire of tests to remain competitive with the least disruption to the existing service. An LBMS that provides full traceability and audit capabilities is now increasingly needed to enable compliance with onerous accreditation processes and audits that may otherwise require days or weeks of preparation. This incorporates the assessment process in daily activities that is easily visible on the day of the accrediting authority visit.

Ultimately, pathology is often seen as a driver of medical cost that in many parts of the world continues to receive a shrinking slice of healthcare budgets. There is an understandable fear that new technologies and tests — including personal genetic testing, other molecular testing and an expanding repertoire of diagnostic molecules — could escalate costs.

Any service improvement must consequently be evaluated against a clinical outcome that is measurable and quantifiable for the patient. This requires easy integration of laboratory results with the electronic patient record to support clinical decision-making and minimise over-ordering of tests.

In this environment, driving continuous improvement is a prerequisite for laboratory survival, as is the need for underpinning information analysis that supports the management of the laboratory and empowers staff to contribute to sustainable service provision.

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

**Dr Gene Elliott MBChB, FC Path (micro), M Med (micro), MBA, is a Physician Executive for InterSystems and has practised as a pathologist in both the private and public health sectors. Previously she was Head of the Department of Microbiology at the University of the Free State School of Medicine in Bloemfontein, South Africa. As part of her MBA she focused on lean management and has spent more than 10 years practising as a physician in both rural and urban settings before pursuing her specialisation. Dr Elliott is based in Johannesburg, South Africa, and advises a wide range of organisations at a strategic level on clinical and operational matters.*



Laminar flow cabinets

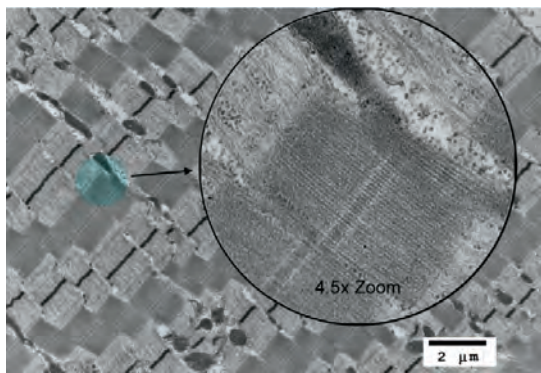
Air Science's Purair FLOW series laminar flow cabinets are designed to protect the work surface, products and materials from particulate contamination. Room air first passes through a HEPA filter then uniformly through the cabinet interior by laminar flow to protect work from unfiltered air. Airflow is oriented to exhaust airborne particulate introduced by the user.

The product line employs Multiplex HEPA filtration technology to sustain the contamination-free environment. Offering ISO Class 4 product performance, the cabinets are intended for use in non-hazardous applications where biological or biohazard by-products are not generated and user protection is not required. A range of innovations is integrated into the clean, simple, low-maintenance design, offering flexible access to the interior work area.

The cabinets are available in three model sizes with various options. They are designed for desktop use or may be installed on an optional base stand or mobile cart. The HEPA filters are easy to replace, with no tools required.

The flow cabinets maintain a 0.45 m/s airflow velocity, measured 150 mm from the filter face, with a uniformity of $\pm 20\%$ across the filter face. The face velocity is in compliance with international standards for safety and performance.

LAF Technologies Pty Ltd
www.laftech.com.au



TEM CCD camera

AMT's XR16 CCD camera represents the latest in larger format CCD sensors. The camera is a suitable choice for clinical pathology and other applications routinely running at microscope magnifications below 50,000x.

The camera is positioned directly beneath the fluorescent screen of the TEM, thus affording a wide field of view. The mid-mount configuration encounters virtually no projector distortion and its high-definition, finite conjugate lens provides sharp images with high sensitivity. With the fixed camera and lens assembly, there is no need for pneumatic insertion.

The simplest diffraction patterns are difficult to acquire using CCD cameras. The nature of diffraction patterns demands the ability to provide full fidelity of weak and extremely intense spots or rings. For user convenience, the majority of modern CCD cameras provide anti-blooming properties. This is a built-in feature of the AMT XR16. The lens systems are designed and rated for the resolution limit of the CCD at full aperture and full field.

Scientex Pty Ltd

www.scientex.com.au

Automated liquid handling system

The Microlab NIMBUS is a compact, multichannel automated liquid handling system offering speed, flexibility, ease of use and good pipetting performance. In contrast to large, multi-integrated, high-end systems designed for automating complex workflows, the product is a small-footprint, lean-integrated, entry-level pipettor suitable for automating a single or select set of liquid handling routines.

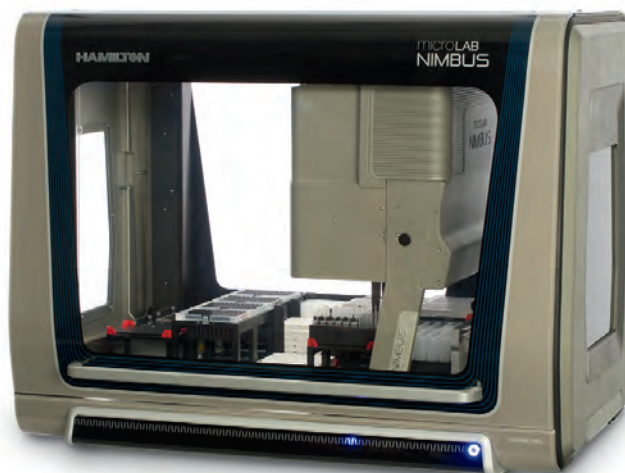
A flexible deck layout and a broad range of modular accessories and options make reconfiguration for new applications quick and easy. The system is available in three pipetting options, each with a variety of highly configurable base platforms such as Open, Enclosed, Extended Enclosed and Large Extended Enclosed.

The NIMBUS4 offers four independent 1 mL liquid channels or two independent 5 mL liquid channels. The NIMBUS96 features a 96-channel multipipetting head (MPH), while the NIMBUS384 offers a 384-channel MPH. The NIMBUS4 HD features 1–4 independent 1 mL liquid channels and now includes 20 ANSI SLAS deck positions.

Integrated options, intuitive software and the backing of Hamilton's service and applications support team make the system suitable for many labs. The company's air displacement pipetting technology is said to give the product the same liquid handling performance as higher-end systems.

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Blasting cancer cells with plasma

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University of South Australia (UniSA) scientists have contributed to the discovery that cool jets of plasma stimulate cells in the bodies of mice, helping to close wounds or kill tumours.

In collaboration with researchers from Kochi University of Technology, Meijo University, Kochi Medical School, Toyohashi University of Technology and Kwangwoon University, Dr Endre Szili and his team from UniSA's Future Industries Institute found that plasma could be used to influence the operations of cells.

"Under some circumstances," Dr Szili said, "you can use the plasma to directly intervene with certain cellular signalling processes, which is quite important for driving a whole range of biological and physiological processes."

Plasma jet therapy works by activating oxygen and nitrogen molecules in the air using a benchtop plasma unit. These molecules — collectively known as reactive oxygen and nitrogen species (RONS) — are part of the cellular signalling process. Long thought to be detrimental to the health of the body and a contributor to ageing, RONS have now been shown to have benefits if levels are carefully monitored.

"People have realised that you actually need RONS to survive, so the cells in your own body actually manufacture their RONS, and they help in the cellular signalling processes and can also help in the fight against diseases," Dr Szili said.

"But it's still necessary to be able to control the dosage of the plasma-generated RONS into the tissue mass, because these RONS can also be damaging to cells."

In order to safely deliver RONS to cells, the Future Industries Institute has developed a hydrogel dressing which can be used to indirectly apply plasma to tissues in the body. Dr Szili explained, "We've used the plasma to activate these dressings, which are usually applied to wounds.

"What this does is removes the potentially quite damaging shorter lived and highly reactive oxygen and nitrogen species because they're filtered out.

"Then you have the longer lived reactive oxygen and nitrogen species which are left

reactive, and they can also be quite beneficial for stimulating wound healing."

In studies conducted in mice, said Dr Szili, "we've shown that plasma can be used to deliver signals into a solid tumour and we've shown that you're able to trigger cell death within the cancer mass".

"This could potentially explain how plasma could be used as a targeted therapy, because you can aim the plasma just at the site of the tumour," he said. This is in contrast to current treatments such as laser or radiation therapy, which are untargeted and often see patients suffering skin damage as a result.

The mice trials were completed in 2016 and are expected to progress to pigs this year. Human trials are projected to be less than 35 months away.

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University of South Australia

www.unisa.edu.au

Temperature controller

Oven Industries has introduced to the market the 5R9-355 Temperature Controller (Peltier Effect).

The product includes a complete mechanical enclosure with mounting holes, user-friendly keypad menu selections and a vivid LCD display. It offers temperature resolution of 0.01°C and control stability of $\pm 0.1^\circ\text{C}$.

The product was designed for applications needing a temperature control range of -40 to 250°C. The company also offers a complete line of temperature sensors.

Oven Industries



Inline load cell for biomedical research testing

Many medical facilities utilise load cells during delicate research studies, such as biomaterial testing. This type of testing requires measurement feedback that is accurate and precise.

Biomedical researchers often work with sensitive and delicate materials. Load cells give researchers the ability to monitor the force applied to their test specimens. Futek's solution for biomaterial testing includes its inline load cell (LCM Series) paired with instrumentation and software.

The LCM Series inline load cell can be mounted to a linear actuator. As the actuator drives the needle into the biomaterial, the load feedback is displayed on the company's IHH500 or IPM650 digital displays or alternatively, streamed through a USB onto a PC.

Pairing SENSIT Test and Measurement Software with any of these instrument options provides the user with the ability to data log and live graph information.

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Petri dish media filler

Compact in design, the MEDIAJET from INTEGRA offers the flexibility to fill Petri dishes of various sizes, Petri dishes with two compartments or test tubes of various diameters and length. The product offers automated preparation of consistent high-quality, contamination-free media in Petri dishes and test tubes.

The surface of the filling chamber is manufactured from a single piece of chemically resistant polyethylene, which allows efficient cleaning. In addition, the device is equipped with a UV lamp extending over the full length of the rotor where dishes/tubes are opened during the filling process. The lamp emits powerful 2.1 W UV-C radiation to ensure complete elimination of bacterial activity in the area most vulnerable to contamination.

The system has a built-in 'Agar Spread Function' that ensures homogenous distribution and an even surface on media. This helps to optimise the media level in Petri dishes, resulting in a reduction in media costs.

Typical production variations in the diameter or shape of Petri dishes are easily handled by the unit, as they are actively guided throughout the entire filling process. The optical dish sensors of the product can be easily adjusted to virtually every Petri dish brand at the user interface level.

Designed to be quickly productive, the intuitive user interface makes it easy to control all functions of the device. The operation of the system is entirely self-explanatory, as all functions and prompts are explained in plain, unambiguous language.

VWR International Pty Ltd

www.au.vwr.com

Particle-by-particle size and concentration measurement with fluorescence detection

Nanoparticle Tracking Analysis (NTA) uses the properties of both light scattering and Brownian motion to characterise individual nanoparticles in a liquid suspension in real time. The technique is fast, robust and accurate, representing an attractive complement to existing methods of nanoparticle analysis such as dynamic light scattering (DLS), photon correlation spectroscopy (PCS) and electron microscopy (EM).

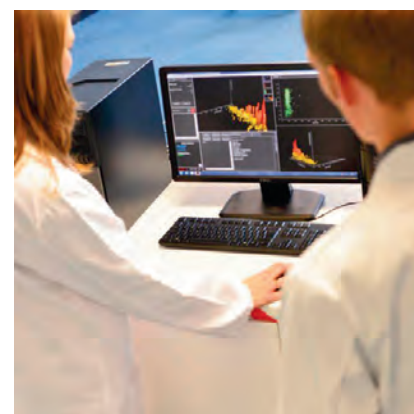
The NanoSight NS300 from Malvern Instruments uses NTA to analyse particles in liquids from 10–2000 nm in diameter. The easy-to-use, reproducible platform delivers simultaneous measurements while visual validation of results gives the user extra confidence. As well as particle size distribution and concentration, protein aggregation and viscosity can all be analysed while a fluorescence mode provides detection of labelled particles.

Nanoparticle Tracking Analysis is a high-resolution particle sizing technique suitable for polydisperse systems. The NanoSight NS300 offers minimal sample preparation, user-friendly software with easy set-up of SOPs for routine use and the option of automated multiple sample analysis when used with a syringe pump or autosampler.

Applications include the development of drug delivery systems, viral vaccine research, nanotoxicology, protein aggregation studies, exosomes and microvesicles (extracellular vesicles) characterisation and more.

ATA Scientific Pty Ltd

www.atascientific.com.au



Valveless piston pump

CeramPump valveless piston pumps from Fluid Metering, Inc (FMI) utilise only one moving part in the fluid path, which accomplishes both the pumping and valving functions, thereby eliminating check valves and the associated reliability and maintenance concerns.

The pump has internal components made of sapphire-hard ceramics that are chemically inert, dimensionally stable and abrasion resistant. For fluids that tend to crystallise, the pump is available with a special wash gland feature, which essentially isolates crystal-forming fluids from the atmosphere.

STAUFF Corporation Pty Ltd

www.stauff.com.au



Clutching at straws

The science of spill prevention

It doesn't take a genius to know that if you knock a glass of water on its side, the liquid will spill out. However, if you happened to be drinking your water through a thin straw, some of the liquid will be retained within this straw — even when turned on its side.



© stock.adobe.com/au/EvanTravels

But what is it exactly that makes this possible? Is it down to the size of the straw, its shape, its material or something else entirely? Seven years ago, Professor Andrew Parry, Dr Carlos Rascón and Professor Dirk Aarts began the calculations that would eventually provide them with the answer.

If you look closely at water in a glass, you can see the edges curve up slightly, so that the surface of the water looks like a shallow bowl. This is due to the force of surface tension, a phenomenon that determines how the liquid surface touches the sides of the glass. The majority of the liquid in the glass is not held this way, so that when the glass is tipped to the side, the force of gravity wins and all the liquid spills out.

On the other hand, if the diameter of the glass is small enough, such as in a very thin straw, then gravity is not able to overcome the forces of surface tension and the liquid remains within the tube. This is why drinking straws, or capillaries in pens, are only a few millimetres across.

However, the researchers found that this apparently simple rule relating to the size of the tube opening breaks down when its cross-section is changed from being circular to being elliptical or triangular. In this case, it is possible that the liquid will spill even when the tube is microscopically small.

Writing in the journal *Proceedings of the National Academy of Sciences*, the researchers propose that if the size and shape of a tube are

carefully designed, the area of the exposed liquid surface could change dramatically in response to small changes as it crosses the threshold from staying put to spilling out. Their precise calculations could have application in technologies that have liquids present at small scales — such as biomedical diagnostics, oil recovery and inkjet printing — where choosing the right tube shape could be as important as its size.

“We have discovered that it should be possible to create minute straw shapes that would mean that any liquid spills or empties out of the tube, no matter how thin it is,” said Professor Parry.

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Disposable paper sampling spoons

EcoTensil Disposable Paper Sampling Spoons from Bel-Art – SP Scienceware are made of a coated paperboard that stands up to powders, gels and semisolids. The spoons lay flat when stored and, in one simple step, fold into a functional spoon for sampling and retrieving materials, making them a space-saving addition to any laboratory or testing facility.

Said to use 50–90% less material than comparable-volume plastic spoons, the sampling spoons are compostable and recyclable. They can also be used as weigh boats, eliminating the need for glassine sheets.

Rowe Scientific Pty Ltd
www.rowe.com.au



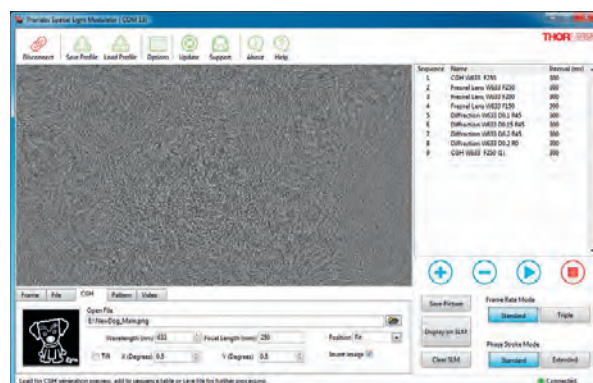
Exhaust trap for lab vacuum pumps

Asynt has announced a post-pump adapter kit that enables its CondensSyn air condenser to be used as an effective exhaust trap for laboratory vacuum pumps. The high-surface-area air condenser is both safe and operationally effective, ensuring optimum heat removal as vapours pass along its length.

Rotary evaporators typically have an integral water or dry ice condenser which, when combined with a well-controlled automatic vacuum pump, provides an effective trap for most solvent vapours. However, some solvent will always escape the condenser trap and make its way into the exhaust of the vacuum pump and out into the laboratory environment.

The CondensSyn air condenser and adapter kit has been shown to trap additional vapours escaping from rotary evaporators, ensuring a greener and more worker-safe environment without using any additional cooling water or dry ice. The air condenser also incorporates a non-roll feature to help prevent accidents if left on a lab bench. Offering clear visibility of ongoing experimental reflux, it is easy to clean and maintain.

LabFriend
www.labfriend.com.au



Reflective two-dimensional spatial light modulator

Thorlabs has announced its EXULUS-HD1 reflective two-dimensional spatial light modulator (SLM) based on liquid crystal on silicon (LCoS) technology. The SLM provides high-resolution, high-speed phase modulation with minimal fluctuations, making it suitable for use in a wide range of applications such as optical trapping, beam steering and shaping, femtosecond pulse shaping, adaptive optics, display and imaging, and holography.

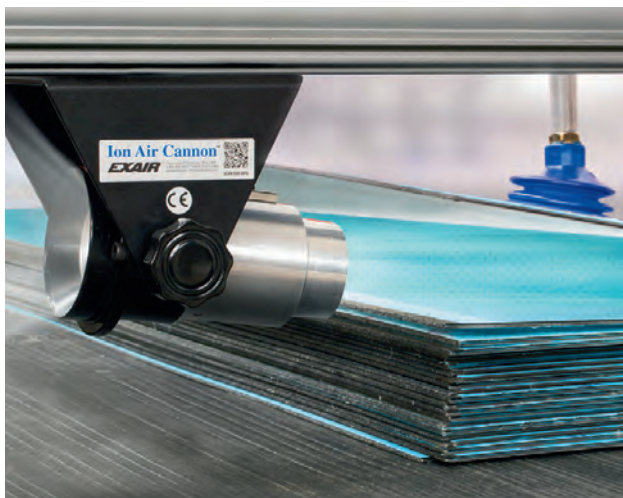
The product includes a built-in SLM panel with 1920 x 1080 resolution, 6.4 μm pixel pitch, 93% fill factor and a 12.5 x 7.1 mm active area. With operation from 400 to 850 nm, it offers a phase stroke of 2 π at 633 nm (standard mode) and 5.7 π at 532 nm (extended mode).

The unit is driven by a standard digital video interface (HDMI) signal and provides a refresh rate of 60 Hz in standard mode and 180 Hz in the frame boost mode. The configuration parameters and easy-to-use software interface facilitate the high performance of diversified applications ranging from standalone functions to integrated research-grade systems.

The product is bundled with a software graphical user interface (GUI) that provides complete control over the device and supports different driving modes including full frame, image input, video input, Fresnel lens, diffraction and computer-generated holography (CGH). The CGH mode also allows tilting and focusing effects to be superimposed onto a pattern to achieve combined functionalities.

The built-in SLM panel provides independent horizontal and vertical tilt adjustment of $\pm 3.2^\circ$. Customised versions that have the panel separated from the control unit are also available on request.

Lastek Pty Ltd
www.lastek.com.au



Air cannon

EXAIR's Ion Air Cannon eliminates static electricity and cleans at distances up to 4.6 m, with no moving parts. It is suitable for benchtops, machine mounting and those hard-to-reach spaces that require a concentrated flow of static-eliminating ions.

The product has undergone independent laboratory tests to certify it meets the safety, health and environmental standards of the USA, the European Union and Canada that are required to attain the CE and UL marks. It is also RoHS compliant. Design features include a metal-armoured high-voltage cable to protect against abrasion and cuts, a replaceable emitter point, an integrated ground connection and electromagnetic shielding.

The device incorporates EXAIR's Super Air Amplifier that minimises compressed air use by inducing surrounding airflow at a ratio of 22:1. The amplified airflow carries the ions to the target, making it possible for the product to eliminate static charges in less than half a second. Air volume and velocity are controllable from a 'breeze' to a 'blast' to gently wipe or forcefully blow away contaminants.

The product comes with a sturdy stand that incorporates a swivel adjustment for directing the airflow. A hose or tube can be easily connected to the air intake to draw air from another area. The electrical ion source is shockless and there is no radioactive element. Applications include bag opening, sheet separation, cleaning moulded parts, pre-paint dust removal, package cleaning and container neutralisation.

Compressed Air Australia Pty Ltd
www.caasafety.com.au

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GFP-Trap® and RFP-Trap® are well established high quality tools for the fast, reliable and efficient one-step isolation of green and red fluorescent fusion proteins and their interacting factors. Nano-Traps are used for:

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- P53 N-term-Trap

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Low-retention pipette tips

INTEGRA has introduced Low Retention pipette tips based on its GripTips multilobe design.

In creating the product range, the company has used a polypropylene blend to produce pipette tips with increased hydrophobic properties. Unlike silicone-coated pipette tips which can wash or leach out with the sample, the blended-polymer Low Retention GripTips will not negatively impact the user's results.

Using standard pipette tips to pipette viscous samples, detergents and other low surface tension liquids can cause pipette tips to take on hydrophilic properties resulting in the spreading out of sample. In this type of application, the product can improve the user's pipetting results. The heightened hydrophobic properties of the tips prevent samples from spreading out, enabling maximum liquid recovery.

Featuring a low attachment force and a low ejection force, the product effortlessly snaps onto pipette tip fittings and is easily ejected. Used in conjunction with INTEGRA pipettes, the tips offer a high lateral resistance,

ensuring they are always firmly attached and aligned — regardless of how many side well touch-offs are performed. Users no longer have to hammer their pipette tips on or worry about pipette tips falling off.

The pipette tips are available for the complete range of INTEGRA pipettes, from the EVOLVE manual pipette to a VIA-FLO 384 multichannel pipette and everything in between. They are offered in 6000 series racks as non-sterile, sterile and filter options.

BioTools Pty Ltd

www.biotoools.com.au



Pipette tip rack

Mettler-Toledo's Rainin TerraRack is said to be sturdy as a conventional pipette tip rack, yet made with less than half the plastic and completely recyclable. The hinged shell is made from PETE, which is easily recycled and in high demand.

Single use and non-refillable, the rack can be used independently or with a re-usable TerraBase for added support and stability. It is also lightweight and easy to store.

For convenience and cleanliness, the rack is presterilised, eliminating the need to autoclave. It is available in LTS and universal-fit tips.

Mettler-Toledo Ltd

www.mt.com



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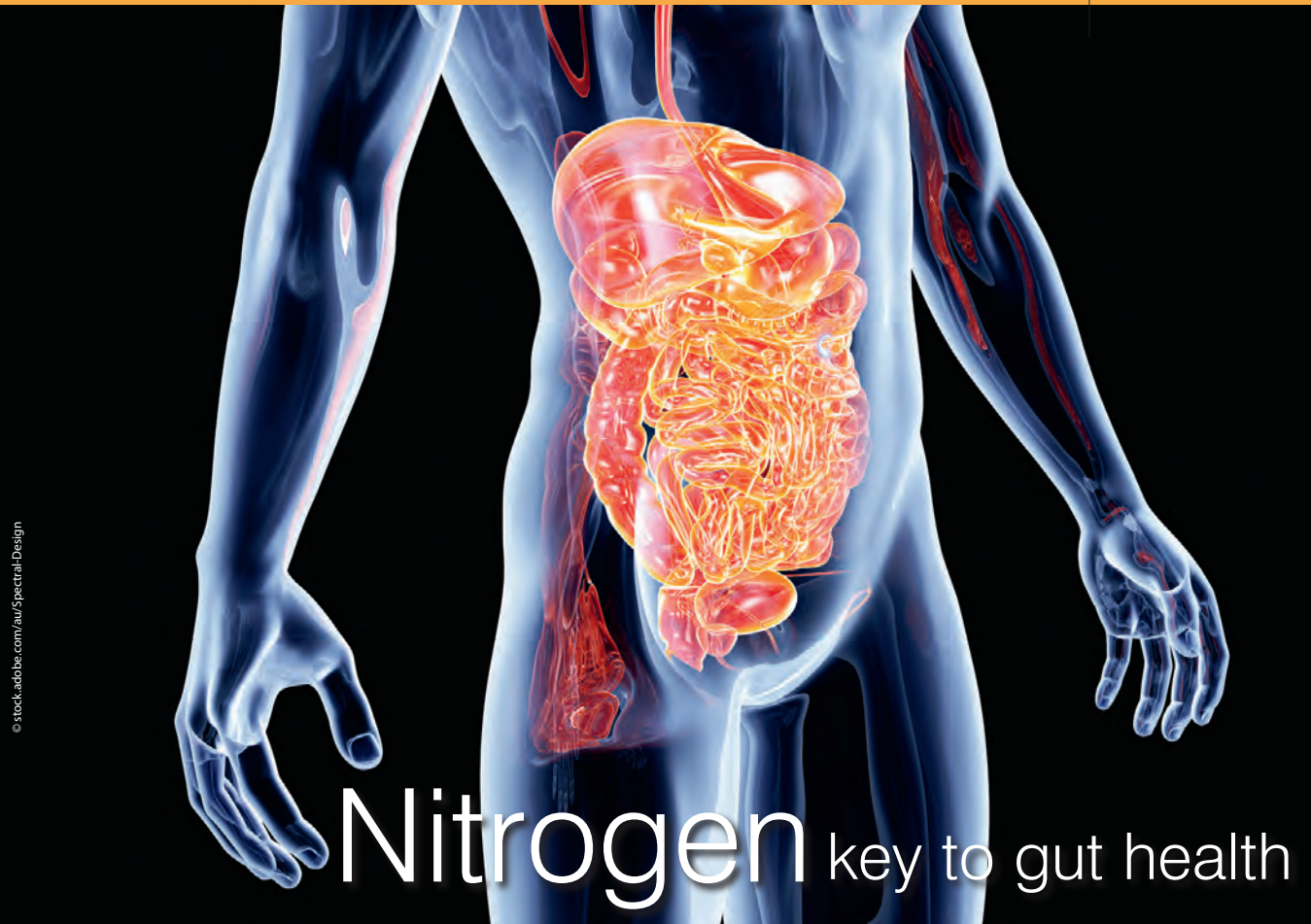


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Nitrogen key to gut health

Researchers at the University of Sydney's Charles Perkins Centre are at the forefront of a new study that may help us predict the ideal diet for optimal gut health. A collaboration between Australian and Norwegian scientists, this new research has developed the first general principles on the impact dietary balance plays on microbiota.

Intestinal nitrogen is the key to regulating interactions between the microbes that live in our gut and their host organism. Lead author Associate Professor Andrew Holmes, from the Charles Perkins Centre and School of Life and Environmental Sciences, said, "There are many different diet strategies that claim to promote gut health, and until now it has been very difficult to establish clear causality between various types of diet and their effect on the host's microbiome."

Diverse factors such as genetics, eating patterns and food composition have made it difficult to determine optimal strategies for promoting gut health, but now researchers will be able to develop more accurate computer simulations, testing multiple diet variants, to predict ideal dietary combinations.

Co-author Professor Stephen Simpson, academic director of the Charles Perkins Centre,

explained, "There are many ways to achieve a good diet, and the same diet won't work in the same way in each person. The next step will be to more rapidly characterise which dietary combinations promote the best outcomes for each of our gut microbiomes, and to this end we are developing a computer simulation for how this might work in practice."

Previous studies identified patterns on how diet influences gut health but were unable to achieve a workable model explaining microbial responses to different types of diets.

Professor Holmes said, "This research really lays the groundwork for future modelling by setting out the rules for a general model of how diet shapes the gut ecosystem. The simple explanation is that when we eat in a way that encourages cooperation between ourselves and bacteria we achieve a good microbiome, but when

we eat in a way that doesn't require cooperation this lets bacteria do whatever they want — and mischief can ensue."

This mischief can lead to problems like diabetes and obesity.

Professor Holmes added, "The largest nutrient requirements for our gut bacteria are carbon and nitrogen in the foods we eat. As carbohydrates contain no nitrogen but protein does, the bacterial community response to the host animal's diet is strongly affected by this diet's protein-carbohydrate ratio ... the microbial ecosystem is fundamentally shaped by a need to access nitrogen in the intestinal environment."

Published in *Cell Metabolism*, the research was led by the University of Sydney team in conjunction with EWOS Innovation of Norway, the ANZAC Research Institute, Concord Hospital and the University of Western Australia.



Evaporator control software

The latest version of Genevac's autostop when dry control software allows the company's EZ-2, Rocket and HT-Series evaporators to automatically detect when the samples are dry and then shut down, safeguarding valuable samples from potential thermal degradation. Combined with Genevac's continuous running condensers, the software allows easy unattended operation offering the possibility of significant increases in productivity through use of overnight evaporation runs.

Evaporator users previously had to constantly monitor or estimate the drying time for a given sample. The autostop when dry control software overcomes this problem by using one of two methods to determine when dryness has been reached and then automatically shutting down the evaporator without further user intervention.

With Genevac evaporators, the software detection of sample dryness is determined either by the rate of heat flow into the sample or by temperature convergence using prepositioned probes in the sample holder and sample. Either method offers significant time savings over traditional manual methods, as well as freeing up operator time for other more productive tasks.

Scitek Australia Pty Ltd

www.scitek.com.au

Vacuum manifold

The Resprep VM-96 vacuum manifold, from Restek, is suitable for everyday solid-phase extraction (SPE), supported liquid extraction (SLE), protein precipitation (PPT) and filtration applications. It is designed for good performance, versatility and ergonomics.

The unit is compatible with 96-well plates from any manufacturer. It has a heavy-duty stainless steel and aluminium body so it stays in place better than lighter models and is precision manufactured so parts assemble quickly and easily.

The built-in viewing window allows for easy observation of plate height and drip rate, and the durable O-ring and gaskets provide leak-free seals. The product includes a precision height adapter and five shims so users can customise plate height to their exact requirements.

Leco Australia Pty Ltd

www.leco.com.au



Latex bead conjugation kits

Innova Biosciences has introduced a range of LATEX Bead Conjugation Kits. The simple-to-use, one-step kits are suitable for covalently conjugating antibodies, proteins and peptides (or any other biomolecule with an amine group) to specially treated latex beads without the need for extensive optimisation.

The latex conjugation reaction has been developed using the company's expertise in simple and quick one-step antibody conjugations. It takes 30 s to set up the one-step conjugation reaction, 3 min hands-on time and 35 min total time until the conjugates are ready to use.

The specially treated latex is resistant to aggregation — high yields of functional conjugates can be made without the need for harsh resuspension methods like sonication and vortexing. Only two buffers are used to test for optimal activity, with no extensive pH optimisations as is typically required for traditional passive conjugation methods.

The 400 nm latex beads are available in red, blue or black. Mini kits are suitable for antibody screening or 'proof of principle' experiments. Midi kits, which are 10 times the size of the Mini kits, are also available. Bulk material is also available for further scale-up.

BioNovus Life Sciences

www.bionovuslifesciences.com.au



Automated sample preparation module for LCMS

Shimadzu has released a fully automated sample preparation module (RUO) connected online for LCMS.

In recent years, there has been considerable progress in the use of mass spectrometers (MS) in the clinical research field due to their ability for high sensitivity detection, high specificity and possibilities of multiplexing analysis without the risk of cross reactions inherent to immunoassays.

In order to automatise the pretreatment of blood or other biological samples before LCMS analysis, Shimadzu has developed a fully automated sample preparation module called

CLAM-2000 (Clinical Laboratory Automated sample preparation Module). The CLAM-2000 (RUO) is an automatic pretreatment system designed for customers that handle blood samples in pharmaceutical departments, medical departments or biological analysis laboratories that are dealing with issues of variability in analytical results or infection risk.

By simply placing blood collection tubes in the system, the product performs all other processes through to LCMS analysis automatically. Unlike dispensing systems, that are based on batch processing 96-well plates, the module is completely automatic from pretreatment to analysis and processes individual samples successively in parallel. Consequently, it results in uniform pretreatment times between samples, without slowing processing speed, and improves data reproducibility.

Shimadzu Scientific Instruments (Oceania) Pty Ltd

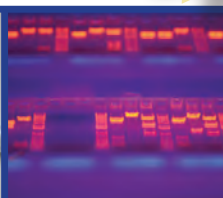
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Laboratory fume hood

The UniFlow CE AireStream is a full-duty fume hood in a compact size that is said to offer 50% energy savings over conventional hoods. The hood is equipped with the vector-slotted rear VaraFlow baffle system.

CE fume hoods are offered in 76, 91, 122 and 183 cm widths and can be equipped with a wide selection of accessories to meet the user's specific process needs. They are constructed totally of composite resin for good chemical resistance and no rust, and can be supplied with or without an exhaust blower in standard or explosion-proof models.

HEMCO Corporation

www.hemcocorp.com



Module for single-cell RNA sequencing

Dolomite Bio has launched an Injection Valve and Sample Loop for single-cell RNA sequencing workflows. This option enables straightforward, gentle introduction of evenly distributed mRNA capture beads into the company's RNA-Seq System for individual encapsulation of cells.

The Injection Valve and Sample Loop is a complete module allowing barcoded mRNA capture beads in lysis buffer to be efficiently flowed through the RNA-Seq Chip without clustering or blockages. Bead damage prior to encapsulation is negligible as harsh mechanical stirring is unnecessary, and its four-way valve and simple, compact microfluidic connections enable seamless switching between the injection of the bead suspension and pumping of a driving fluid, with minimal dead volume and bead wastage compared to traditional syringe pump methods.

The integrated mirror and chip holder enable easy visualisation via the RNA-Seq System's high-speed microscope and camera, and the module also incorporates a Falcon/Eppendorf tube holder for easy collection of the droplet emulsion.

John Morris Scientific Pty Ltd

www.johnmorris.com.au



Rotameters

AALBORG Instruments offers rugged, high-range PTFE/PFA Model L Rotameters constructed of rigid frames and inert wetted parts. Made of PFA, PTFE and PCTFE, the meters are resistant to ambient corrosives.

The upper and lower (non-fluid contacting) end fittings are fabricated of polypropylene, which has good corrosive-resistant properties coupled with mechanical structural rigidity. Constructed with or without built-in needle valves, the meters are easily mountable via panel nuts.

The units are individually leak tested and each meter is supplied with a safety shield. Direct reading metric/English system scales are now available for liquids (specific gravity=1.0).

Pryde Measurement Pty Ltd

www.pryde.com.au



Pharmaceutical and biopharmaceutical companies and contract manufacturers are increasingly adopting single-use systems to replace expensive stainless steel vessels and piping for high-purity fluid transfer in processing operations such as sampling and batch and vial filling. Stainless steel, while strong and durable, requires aggressive cleaning, poses the risk of contamination and makes it cumbersome and inefficient to switch from one drug to another.



How to optimise silicone tubing in single-use systems

Single-use systems consist of multiple components connected with heat seals, overmoulds or mechanical fasteners. They often include a bag, a supporting frame and a mixing attachment. Ports or openings in the bag allow fluid input and output via tubing assembly systems, sometimes in conjunction with a pump.

Silicones offer critical advantages for tubing assemblies: they bring a long history of safety, purity from their low level of extractables and particulates, and biocompatibility in healthcare applications, documented with exhaustive testing. Silicone elastomer tubing can be used in a wide temperature range (from -80 to +215°C) because of silicone's low glass transition temperature and thermal stability. Consequently, silicones are typically more suitable for autoclave sterilisation

and also for low-temperature storage applications than most thermoplastic tubing. Flexibility, resilience, kink and pressure resistance are also major benefits of silicone elastomer tubing for pharma and biopharma processing.

Critical performance challenges for any tubing assembly include maintaining system integrity under pressure, after gamma irradiation and autoclaving, and minimising extractables and particulates. Optimising the assembly calls for a detailed understanding of silicone properties and performance. For example, preventing or minimising leakage caused by pressure at assembly connection points requires expertise in multiple areas, from understanding the performance of the polymeric material design parameters to testing and analysis.

Many pharma and biopharma companies, contract manufacturers and integrators, particularly those accustomed to using stainless steel equipment, may lack this detailed understanding. The best way

to obtain such understanding is by partnering with your silicone supplier. Typically, a leading silicone manufacturer will be able to offer extensive material and application testing capabilities, global resources and specialised facilities to support its customers. Collaboration with the silicone manufacturer can benefit integrators and end users in multiple ways.

Partnering with the silicone supplier

Regulatory compliance

Global regulatory requirements are increasingly focused on the biocompatibility of materials that contact drug products or could potentially leach into them. End users and integrators need to know whether the single-use components contain any undesirable materials such as genetically modified organisms (GMOs), animal-derived ingredients, natural rubber, latex, organic impurities or phthalates. Dow Corning is a vertically integrated supplier that retains control over each process — from synthesising the silicone polymer and

formulating the silicone elastomer to extruding and fabricating the components and delivering the tubing or subassembly. This company can help strengthen compliance with regulatory requirements. Its vertically integrated supply chain enables change control, reliability of supply, traceability and consistent quality.

Further, suppliers such as Dow Corning have the expertise and capabilities to test the effects of gamma irradiation and other sterilisation techniques on the level of extractables in silicone tubing and subassemblies. Although the silicone elastomers used for these applications typically should not contain plasticisers, stabilisers, ultraviolet (UV) absorbers or antioxidants, test results can provide valuable information to determine a product's suitability for your application.

Performance optimisation

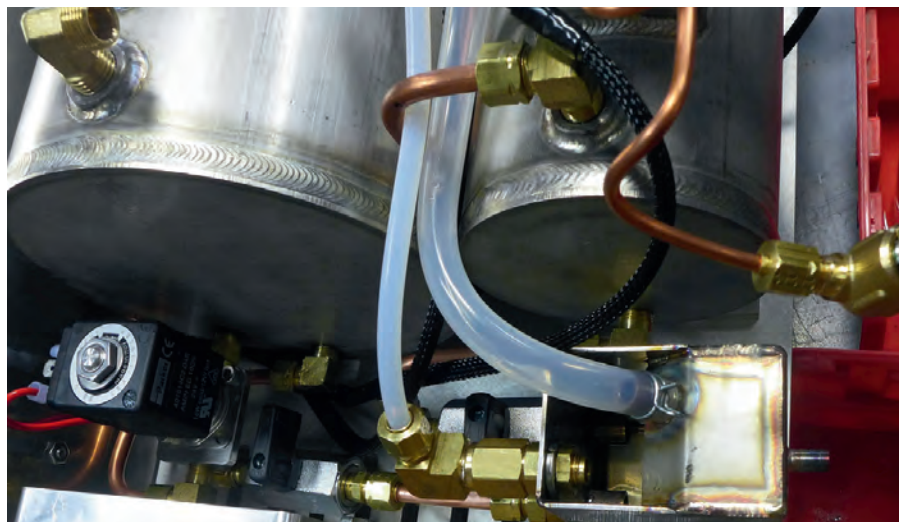
Silicone tubing and subassemblies are subjected to sterilisation before use, and to various temperatures and pressures during fluid transfer operations. Silicone manufacturers with extensive testing capabilities can conduct performance analyses of materials and components to evaluate the stability of key mechanical properties, such as tensile strength, modulus and elongation. They can test for pressure-induced changes in the diameter of silicone elastomer tubing following sterilisation and recommend the most suitable tubing type for the specific application.

Another valuable test that a silicone supplier can conduct is assessing the potential for subassembly leakage at connection points and bursting under high pressure. The testing results can then be related to factors such as wall thickness, inside diameter, formulation and type of connection. Material variables including durometer (Shore A hardness), crosslink density and reinforcing fillers can be adjusted by the supplier to meet specific pressure resistance needs. Similarly, tubing and subassemblies provided by the silicone manufacturer, changes in the tubing diameter, wall thickness, connection type and other parameters can be made to optimise performance.

Processing efficiency

The need to reduce project costs and time continues to be a primary driver for implementing single-use systems. Pharmaceutical companies that make the switch to single-use assemblies are looking for improved processing efficiency and productivity, including flexible capacity, fast changeovers and rapid production.

For example, silicone tubing can be altered, adjusted and customised more easily and quickly



than stainless steel piping. This is particularly beneficial for contract manufacturing organisations (CMOs) as it allows them to change their processes more readily and safely compared to traditional methods.

To achieve these benefits, the end user requires the right tubing or subassemblies. When companies work with a supplier that can document the performance of the subassembly and its tubing under various test conditions, they can have greater confidence that the product will perform correctly and adhere to the users' requirements. These tests include evaluation for leakage or bursting, pull-apart strength for assemblies, and pump life and filling accuracy for pump tubing, as well as measurement of extractables, particulates, bioburden and endotoxin for cleanliness.

Providing the solutions

When evaluating possible partners, a company that is vertically integrated can help ensure reliability of supply, traceability and quality control. Vertical integration begins with silicone production and proceeds through basic processing, polymerisation, finishing, testing and packaging.

You can count on consistent quality when your partner produces its materials for the global healthcare sector at a US Food and Drug Administration (FDA) registered clean manufacturing site subject to regular agency inspections, as well as when your partner's facility adheres to the principles of current good manufacturing practices (cGMPs) as defined by FDA guidelines and is ISO 9001 compliant, thereby meeting stringent international quality

standards set by the International Organization for Standardization.

Capabilities the company should provide include comprehensive testing throughout the manufacturing process, from incoming raw materials to final lots, such as chemical and material analysis/characterisation, regulatory compliance and application performance testing.

Conclusion

Single-use systems that use silicone tubing are quickly gaining in popularity for pharmaceutical and biopharmaceutical processing because of their financial and operational advantages over traditional processing with stainless steel. However, to gain the greatest benefits from single-use systems, integrators and manufacturers need to be sure that the silicone material and components they select will deliver consistent performance, high quality and regulatory compliance.

Because an understanding of silicone technology is often outside the core competency of most pharmaceutical manufacturers and integrators, it would be beneficial to work with a recognised supplier that offers extensive knowledge, capabilities and a track record of excellence in the healthcare field. With more than 70 years of experience in silicone technology and manufacturing, Dow Corning is a leading supplier of silicone materials, tubing and subassemblies for pharmaceutical processing, whose extensive knowledge and technical and regulatory resource can guide you as you adopt single-use systems featuring silicone components.

AXIEO Specialties

www.axieo.com

**Csilla Kollar is an Application Engineering and Technical Service Specialist at Dow Corning.*

^Jennifer Gemo is Global Segment Leader for Bio-Pharma Processing at Dow Corning.

°Lise Tan-Sien-Hee is an Application Engineering and Technical Service Specialist at Dow Corning.

Respiratory gas monitoring for small animals

The monitoring of expired gas is an important indicator of the physiological health of experimental animals. CWE offers a range of gas analysers for different respiratory physiology applications.

The CapStar-100 end-tidal CO_2 analyser is suitable for the routine monitoring of CO_2 , providing continuous measurement of expired CO_2 over the range of 0–10%. Its rapid response time, small sample flow requirements and long-term stability make it suitable for respiratory gas measurement of rodents and larger animals.

The microCapStar CO_2 analyser is specifically designed for very small animals, providing end-tidal or continuous measurement of expired CO_2 in animals as small as mice. It features low sample flow requirements, rapid response time and long-term stability. Respiratory rate (RR) is computed using the excursions of the CO_2 waveform. The CO_2 and RR measurements, as well as a trend plot of the end-tidal values, are displayed on the LCD screen.

The GEMINI Respiratory Monitor features both CO_2 and O_2 measurement, as well as RR measurement. Measuring breath-by-breath O_2 and CO_2 concentration, it has long-term stability, linear output voltage, adjustable CO_2 and respiratory rate alarms. It is also suitable for rats and larger animals.

The products are suitable for hypoxia and control-of-breathing studies. They can be used in conjunction with a CWE ventilator.

SciTech Pty Ltd
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Tube capping systems

For researchers seeking to streamline their sample storage processes, Thermo Fisher Scientific and Hamilton Storage have partnered to offer the fully automated Thermo Scientific Decapper 500 and 550 series tube capping systems. The system allows users to cap and decap both Thermo Scientific Matrix and Nunc automation tubes without owning multiple pieces of equipment.

Historically, users have stored biological samples in multiple tube types, requiring them to buy multiple decappers. The decapper system does the work of multiple systems and features Quick Switch technology that seamlessly transitions between different tube and rack types.

The systems are suitable for use in medium- to high-throughput biotech, pharmaceutical and clinical laboratories doing compound storage, high-throughput screening, biobanking and genomic storage. Additional functionality is provided through a built-in barcode reader and the decappers can also cap and decap partial racks of tubes.

Thermo Fisher Scientific

www.thermofisher.com.au



Sterile gloves

When collecting an in-process sample for testing, scientists want to make sure they are not passing contamination to the material they are sampling. They also want to make sure they have not contaminated the sample, which could end up returning false results. This is especially the case when using environmental swabs and sponges. To prevent contamination to the sample, a sterile glove is required.

Nasco Sterile Gloves are easy to use. Each pair of polyethylene gloves is packaged in a sealed bag that is perforated for easy opening. They come in a box of 100 pairs.

Australasian Medical & Scientific Ltd

www.amsl.com.au



HRP substrate

The GeneTex Trident femto Western HRP Substrate can detect horseradish peroxidase in Western blot analysis at the femtogram level. It is said to provide superior protein sensitivity compared to pre-existing ECL reagents in the market.

The substrate is supplied as two components solutions, A and B, for easy mixture and convenience. Features include high sensitivity, a strong signal and a low required amount of starting sample.

Sapphire Bioscience

www.sapphirebioscience.com





Fish in space

A study in gravitational biology

Life in a reduced-gravity environment can have lasting problems on the body, with astronauts undergoing a significant drop in bone mineral density during space missions. Unfortunately, the precise molecular mechanisms responsible for such changes in bone structure are not yet clear.

Seeing to understand these molecular mechanisms, researchers from Tokyo Institute of Technology sent tiny Japanese rice fish — also known as medaka — to the International Space Station (ISS), where they were exposed to microgravity. Performing real-time imaging on the fish, the researchers witnessed the emission of fluorescent signals derived from the fishes' osteoblasts (cells that synthesise bone) and

osteoclasts (cells that break down bone tissue). The results were published in the journal *Scientific Reports*.

The researchers' imaging of osteoblasts showed the intensity of osterix- and osteocalcin-DsRed in pharyngeal bones to increase one day after launch. This increased effect continued for eight days for osterix and five days for osteocalcin. In the case of osteoclasts, the fluorescent signals observed from TRAP-GFP and MMP9-DsRed increased significantly on the fourth and sixth days after launch.

Working from the Tsukuba Space Center in Japan, the team used four different double medaka transgenic lines focusing on upregulation of fluorescent signals of osteoblasts and osteoclasts, and also studied changes in the gene expression in the transgenic fish by transcriptome analysis. They observed increases in both osteoblast and osteoclast specific promoter-driven GFP and DsRed signals one day after launch, which continued for up to eight days.

"HiSeq from pharyngeal bones of juvenile fish at day 2 after launch showed upregulation of 2 osteoblast- and 3 osteoclast-related genes," the researchers wrote. Transcription of the 'nucleus' was enhanced based on whole body gene ontology analysis of RNA-Seq, with the researchers observing transcription-regulators to be more upregulated at day 2 compared with during day 6. Finally, the team identified five genes that were all upregulated in the whole body on days 2 and 6, and in the pharyngeal bone on day 2.

The study serves as a major step towards uncovering the mechanisms governing changes in bone structure immediately after the onset of microgravity, when bone loss is triggered, with the researchers stating that exposure to microgravity induced an immediate "dynamic alteration of gene expressions in osteoblasts and osteoclasts". In their next experiment, the colleagues will clarify the role of glucocorticoid receptor (GR) on cells in microgravity.



Fish image courtesy of yoppy (via Flickr) under CC BY 2.0

RACI Centenary Congress July 23–28, Melbourne

The 2017 RACI (Royal Australian Chemical Institute) Centenary Congress will be an opportunity to celebrate the contributions that chemistry has made to Australia's (and the world's) social, economic and intellectual advancement over the past century, as well as to look forward to the challenges and opportunities in the century ahead.

The congress will encompass the RACI National Centenary Conference and is being held in collaboration with several partner conferences. A breakdown of these conferences can be found in the event listings below.
www.racicongress.com

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ASC2017

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

Divide and concentrate

March 29, Werribee
<https://events.csiro.au/Events/2016/December/22/Divide-and-concentrate>

Realising SKA-Low

March 29–31, Perth
www.icrar.org/conferences/realising-ska-low/

Passive and Active Measurement

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

Solutions for Drug-Resistant Infections 2017 Conference

April 3–5, Brisbane
www.sdri2017.org/

Innovation in Radiation Applications 2017

April 20–22, Wollongong
<http://eis.uow.edu.au/physics/ira-2017/index.html>

Science on the Swan 2017: One Health

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

8th World Conference on Sampling and Blending

May 9–11, Perth
www.wcsb8.com/

ALTA 2017

May 20–27, Perth
www.altamet.com.au/conferences/alta-2017/

Collaborate | Innovate | 2017

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

Science at the Shine Dome

May 23–25, Canberra
www.science.org.au/news-and-events/events/science-shine-dome

ASM 2017

July 2–5, Hobart
asm2015.asnevents.com.au

Australian Marine Science Conference 2017

July 2–6, Darwin
<http://events.amsaconference.net/>

AIMECS2017

July 23–26, Melbourne
www.racicongress.com/AIMECS2017/

Chemeca 2017

July 23–26, Melbourne
www.racicongress.com/Chemeca2017/

International Conference on Green and Sustainable Chemistry Conference

July 23–26, Melbourne
www.racicongress.com/GSC8/

Tetrahedron Asia Symposium

July 23–27, Melbourne
www.racicongress.com/TetrahedronSymposium/

6th Asian Conference on Coordination Chemistry

July 23–28, Melbourne
www.racicongress.com/ACCC6/

Asian Chemical Congress

July 23–28, Melbourne
www.racicongress.com/17ACC/

Carbon 2017

July 23–28, Melbourne
www.racicongress.com/Carbon2017/

RACI National Centenary Conference 2017

July 23–28, Melbourne
www.racicongress.com/RACIConference/

ICPEAC XXX

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

The Asia Hub for e-Drug Discovery (AHeDD) Symposium 2017

July 27–28, Melbourne
www.racicongress.com/AHeDD2017/

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A.B.N. 22 152 305 336
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Head Office

Cnr. Fox Valley Road & Kiogle Street,
(Locked Bag 1289)
Wahroonga NSW 2076
Ph: +61 2 9487 2700
Fax: +61 2 9489 1265

Editor

Lauren Davis
LLS@wfmedia.com.au

Publishing Director/MD

Geoff Hird

Art Director/Production Manager

Julie Wright

Art/Production

Tanya Barac, Colleen Sam

Circulation Manager

Sue Lavery
circulation@wfmedia.com.au

Copy Control

Mitchie Mullins
copy@wfmedia.com.au

Advertising Sales

Sales Manager: Kerrie Robinson
Ph: 0400 886 311
kr Robinson@wfmedia.com.au

Sandra Romanin
Ph: 0414 558 464
sromanin@wfmedia.com.au

Tim Thompson
Ph: 0421 623 958
tthompson@wfmedia.com.au

If you have any queries regarding our privacy policy please email privacy@wfmedia.com.au

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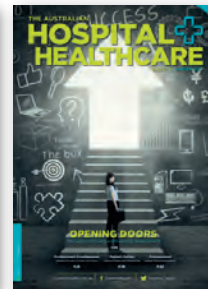
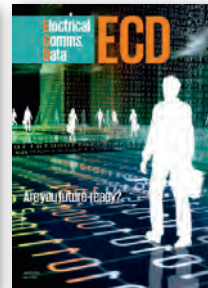
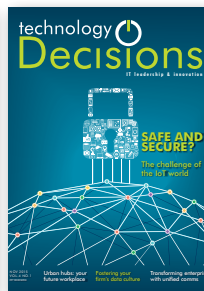
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