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Lupus:
in search of the wolf

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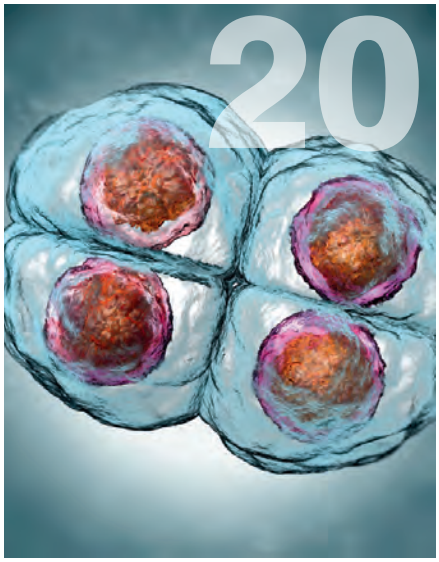

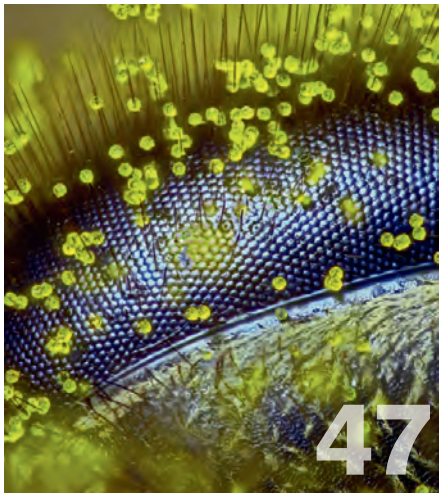

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Shedding light on the dark proteome

Scientists have long speculated about the nature of the dark proteome — the regions of proteins where molecular conformation is completely unknown.

Now, Dr Sean O'Donoghue has led a study to map the boundaries of these dark regions, bringing us one step closer to discovering the complete structure and function of all proteins.

Dr O'Donoghue, a data visualisation scientist with CSIRO and the Garvan Institute of Medical Research, explained that there are regions within each protein that are different to any region where structure has been determined experimentally. These have been coined the 'dark proteome'.

"These dark regions are unlike any known structure, so they cannot be predicted," Dr O'Donoghue said.

"Identifying these areas is very exciting as we now have a map to focus our research efforts."

Dr O'Donoghue and his team utilised Aquaria, CSIRO's web-based tool, which uses data from the Protein Data Bank to create 3D structural models for 546,000 protein sequences. The results of their survey have been published in the journal *Proceedings of the National Academy of Sciences*.

"For 546,000 Swiss-Prot proteins, we found that 44–54% of the proteome in eukaryotes and viruses was dark, compared with only ~14% in archaea and bacteria," the researchers stated. They added: "Nearly half of the dark proteome comprised dark proteins, in which the entire sequence lacked similarity to any known structure."

These dark proteins fulfil a wide variety of functions, according to the researchers, with a subset showing "distinct and largely unexpected features". These included an association with secretion, specific tissues, the endoplasmic reticulum, disulfide bonding and proteolytic cleavage. Dark proteins also had short sequence length, low evolutionary re-use and few known interactions with other proteins.

"These results suggest new research directions in structural and computational biology," the researchers said, suggesting that the work will "help future research shed light on the remaining dark proteome, thus revealing molecular processes of life that are currently unknown".

Dr O'Donoghue added that the dark proteome "undoubtedly plays a key role in human health", with dark proteins abundant in skin and hair, as well as glands that make saliva, semen and milk. The study may therefore provide insight into protein-based illnesses like cancer, type 2 diabetes and many neurodegenerative diseases, such as Parkinson's disease and Alzheimer's.

"We believe that studying the dark proteome will clarify future research directions, as studies of dark matter have done in physics," he said.

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Graeme O'Neill

Geneticists have struggled for years to identify the mutant genes involved in lupus. A three-year-old patient, and a crucial discovery by Professor Carola Vinuesa's ANU research team, will transform diagnosis and treatment of the autoimmune disorder.

Lupus: in search of the wolf

At least 17,000 Australians suffer from some form of the multiple forms of the autoimmune disorder systemic lupus erythematosus (SLE), commonly known as 'lupus'. Lupus is Latin for 'wolf', a linguistic relic of the mediaeval superstition that the characteristic, butterfly-shaped facial rash of cutaneous lupus was caused by a bite from a wolf.

A decade ago, Australian National University lupus researcher Carola Vinuesa embarked on a quest to identify the mutant genes that cause lupus.

A graduate of the Autonomous University of Madrid, Vinuesa is Professor of Immunology at ANU and head of the Immunology and Infectious Disease Department in The John Curtin School of Medical Research (JCSMR). She is also head of The Centre for Personalised Immunology, an NHMRC Centre of Research Excellence, which is now responsible for the lupus project.

It was a daunting assignment: the mutant genes that give rise to lupus in its multiple forms have proved as elusive and enigmatic as the rare lobo of the mountainous north of Vinuesa's Spanish homeland — the Iberian wolf (*Canis lupus signatus*).

Linkage disequilibrium, the original time- and resource-intensive method for tracking down mutant genes, was never a realistic option for a complex disorder like lupus. The diversity of immune-system genes and potentially pathogenic mutations, plus the dearth of extended, multigeneration family pedigrees, made it practically impossible to use comparative genetics to identify chromosome segments or haplotypes harbouring candidate genes.

Vinuesa said the advent of powerful, highly parallel genome sequencing technologies five years ago was the game-changer for her ANU team.

Their groundbreaking study of a three-year-old Lebanese girl with a severe form of

A decade ago, Australian National University lupus researcher Carola Vinuesa embarked on a quest to identify the mutant genes that cause lupus.

lupus, published last December in *Arthritis & Rheumatology*, shed new light on the nature of the genetic defects involved in lupus and signposted a path towards transformative change in diagnosing and treating the disease.

"Two years ago I read a *Nature* article saying the missing heritability in autoimmunity was not going to be due to rare gene variants," Vinuesa said.

"We think that might not be entirely the case. It is likely that the genetic architecture of diseases like lupus and other autoimmune disorders will cover the entire spectrum: from one or a few rare variants to multiple common variants.

"Some cases will be oligogenic (involving a small number of genes), if not monogenic or digenic. Others may yet prove to be polygenic, but the contribution of rare variants with strong effects has probably been underestimated."

Vinuesa said the advent several years ago of new technology for rapid exome sequencing galvanised her team's search for lupus genes. Exome sequencers scan the genome, cherry-picking the protein-coding sequences of genes and skipping the rest — the ~98% of non-protein-coding DNA.

(The logic of exome sequencing is that, whereas mutations in gene promoters or other regions of non-protein-coding DNA may impair protein output, pathogenic mutations that distort protein structure and impair function invariably lurk in the select terrain of the exome.)

Beyond their hunt for the causative mutations in lupus, Vinuesa and her colleagues had more ambitious plans. "We wanted not just to identify rare variants that we thought were strong candidates for involvement in lupus, we wanted to prove causation," she said.

"That really has been a major stumbling block — to convince everyone that these rare variants actually contribute to lupus.

"That hasn't really been possible, except in cases where the gene is a very obvious candidate, like TREX1.

"For the many genes that have less well understood immunological functions, you cannot prove causation unless you make a mouse model.

"Again, that was very difficult to do until last year, when the new CRISPR-Cas9 DNA-editing tools came out.

"Previously, there was no mouse model bearing mutations found in human lupus.

"CRISPR-Cas9 technology now provides a very cheap, rapid way to introduce point mutations we find in lupus patients into a mouse embryo and create precise mouse models for the human disease.

"We've been doing that, and we have some very exciting discoveries. We haven't published them yet, but several should be ready very soon.

"Without going into the details, we have found some beautiful examples of families harbouring two rare mutations in genes coding for proteins that interact with each other and thus operate in the same biochemical pathway."

Vinuesa said the resulting deleterious effects on pathway function are similar to those seen in subjects who inherit two different, mutant alleles of the same gene — the phenomenon, known as compound heterozygosity, is common in, for example, cystic fibrosis.

"We found quite a number of these cases that result in aberrant expansion of autoantibody-secreting B cells. In each case, affected family members inherit a rare mutant allele that occurs at a frequency of less than 1% in the general population, but has a frequency of 6% in lupus patients.

"Each of the lupus patients has a second mutation in another protein that normally interacts with the first, and signals downstream of toll-like receptors.

"Our work shows that these disorders can easily be caused by rare gene variants, and it probably doesn't take many of these rare mutant alleles to cause disease — as few as two or three.

"That's exciting in itself, but being able to replicate those same defects in a mouse model is truly exciting.

"Not only can we use the mouse model to understand the pathogenesis of a particular disorder, we can also use it to trial therapies chosen

according to known molecular defects. We can also now begin to stratify lupus patients, based on our new understanding of the molecular basis of the defects.

"In this particular case we found a B-cell abnormality that tracks with this form of lupus, based on a cytokine profile that associates with specific B cell mutations.

"That's transformative, because we can now accurately predict that patients with this B cell disorder should respond to a particular monoclonal antibody (mAb) that may have been developed for a different therapeutic purpose."

Vinuesa said the past two decades have seen a proliferation of mAb therapies developed for other immune disorders and cancer. Collectively, they constitute a comprehensive, off-the-shelf therapeutic arsenal for treating the various forms of lupus.

Some mAbs have already been used successfully to treat particular forms of lupus; the problem has been to match mAbs to particular forms of the disease, which usually requires multiple rounds of trial and error because there has been no information about the causative genetic lesions.

Carola Vinuesa was a plenary speaker at the Australasian Society's of Immunology's New Horizons conference.

The achievements of Vinuesa and her team should drastically reduce the distance between bench and clinic. Once a mutation is discovered and its pathogenicity studied and confirmed in a mouse model, clinicians will be able to select a ready-made mAb, with high confidence that it will alleviate the chronic misery of a new subset of lupus patients. In some cases, it will save lives.

In 2009, a three-year-old Lebanese girl in Sydney was diagnosed with early-onset cerebral lupus.

Her case was brought to the attention of Vinuesa's team. It would mark the beginning of a new era in lupus research.

They extracted the young girl's genomic DNA from a saliva sample and sequenced her exome — a technique that restricts sequencing to the protein-coding regions.

JCSMR bioinformaticians then scanned her exome for candidate mutations, using algorithms developed in-house that focus on highly conserved regions of genes.

Mutations in highly conserved regions of important genes tend to be highly deleterious — even lethal.

"Many of the mutations we are looking for have high damage scores," Vinuesa said. "They're usually rare and highly deleterious, whereas common mutations tend to be tolerated — that's why they're common.

"If a mutant allele occurs at a frequency of less than 1% in the general population, we know it is less likely to have been purified by natural selection. In the case of de novo mutations, they may not be present in either parent — only in the proband (the original, affected individual)."

Vinuesa said the highest-scoring variant segregating with disease was a homozygous mutation in TREX1, a gene that had not been previously associated with paediatric lupus. However, heterozygous mutations had been shown to cause adult chilblain lupus. Homozygous mutations in TREX1 had also been shown to cause Acardi-Goutiere's syndrome, which typically causes inflammation of the brain.

In unaffected individuals, identical TREX1 molecules pair up to form a homodimer, the protein's active form. Vinuesa's team determined that the young girl's mutation, at residue 97, results in an arginine→histidine substitution that lies within in the interface region between the two molecules. It doesn't disrupt the bond, but drastically reduces the efficiency of the dimer's DNA-degradation activity.

The young Lebanese girl had presented with early-onset cerebral lupus; her symptoms included elevated antibody titres against double-stranded DNA fragments, indicating a defect in the cellular mechanisms that repair or degrade damaged DNA.

The girl also had haemolytic anaemia, lymphopaenia and impaired renal and liver function. She also exhibited elevated levels of interferon alpha, an inflammatory cytokine that was likely to be the primary cause of the inflammation causing her cerebral symptoms.

At age four, she had developed partial paralysis of the right side of her body. Magnetic resonance imaging of her brain revealed partial occlusion of several major arteries and widespread inflammation of medium-sized blood vessels.

There was no known history of lupus in the family, but there was an important familial clue. The girl's parents were first cousins — an ancient tradition of marriage between first cousins is still quite common in many Middle-Eastern cultures.

In a cruel throw of the Mendelian dice, the girl had inherited the same, malfunctioning allele from both parents; they and her siblings were unaffected, indicating they had inherited at least one normal allele of the same gene, compensating for any deficiency due to the mutant allele.

Based on the ANU team's findings, the girl's clinicians are seeking approval to change her current treatment of six drugs with significant toxicity to an anti-Ifα monoclonal antibody, which is still in clinical trials and not yet available for individual patient use.

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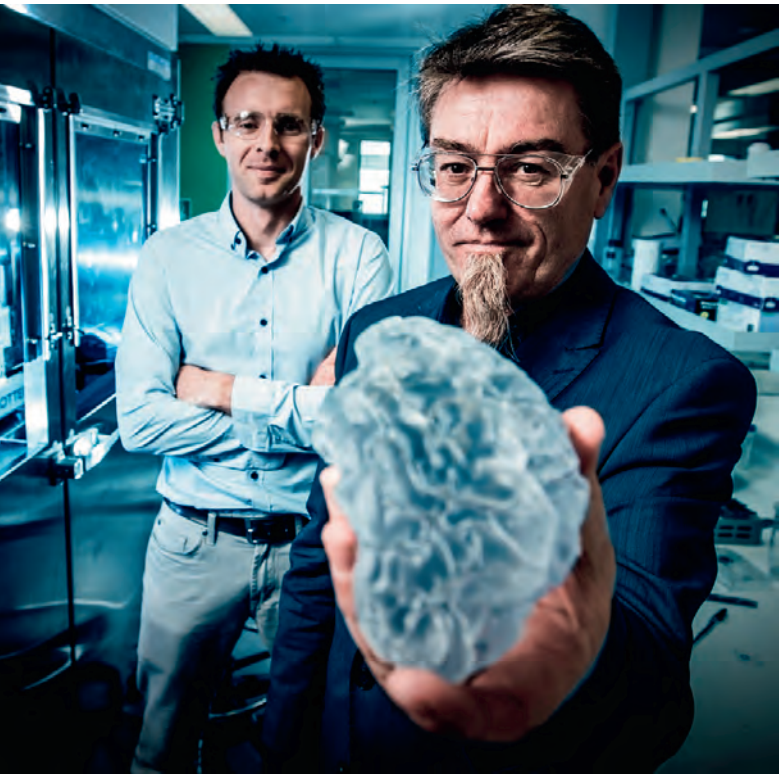


An introduction to printing body parts

The University of Wollongong's (UOW) Australian Institute for Innovative Materials (AIIM) has launched the four-week online course 'Bioprinting: 3D Printing Body Parts', enabling people to discover how the world of 3D printing and biocompatible materials is allowing scientists to rethink approaches to health care.

Made possible through a partnership with global online learning platform FutureLearn, the course will tell the story of the beginnings of 3D printing, how it is currently being used and what will be possible in years to come. It will be led by Professor Gordon Wallace, head of the UOW-headquartered ARC Centre of Excellence for Electromaterials Science (ACES), with equipment and technical support from the Australian National Fabrication Facility (ANFF).

Course material will be presented in language understood by a general audience and will use case studies to illustrate the impact that 3D printing already has on the ability to create customised medical devices. These case studies include the 3D printing of personalised titanium hip implants using selective laser melting, the creation of made-to-fit masks for facial transplant recipients using hot melt extrusion and the potential for lab-grown organs structured through the ink-jet printing of living cells.

The four-week course will require two hours of study per week and is aimed at high-school leavers considering university or current undergraduates. It will provide a taste of what students will learn through undergraduate study at UOW in the disciplines of degrees in science, mechatronics and materials engineering, and later as part of the new master's degree in biofabrication.

To join the course, visit https://www.futurelearn.com/courses/bioprinting.

Chemists create a star-shaped molecule

Chemists from The Australian National University (ANU) have created a star-shape molecule, previously thought to be too unstable to be made, in work which could lead to more efficient ways to make medicinal agents.

The chemical industry worldwide is worth nearly $1 trillion, making everything from cosmetics to cancer drugs. The vast majority of these substances contain rings like radialenes — hyper-reactive molecules which "form more stable substances very quickly", according to lead researcher Professor Michael Sherburn.

"Their reactions are some of the most powerful chemical transformations known," Professor Sherburn continued.

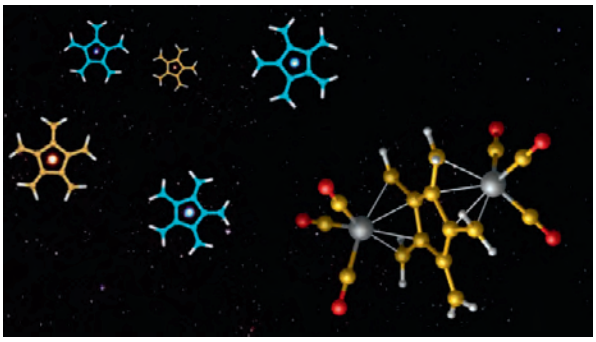
With the help of computations carried out on the Raijin supercomputer by Professor Michael Paddon-Row from UNSW, Professor Sherburn set out to try to create the elusive five-pronged molecule [5]radialene. It took him nearly two years, and three generations of PhD students, to do so.

"Because the structure [5]radialene had never been seen in nature, we had to come up with a really creative method, something new and special," Professor Sherburn said.

"The compound is 10,000 times less stable than the others in the star-shaped radialene molecule family, which are themselves notoriously unstable. A previous research group describes spontaneous combustion of [6]radialene in air."

Writing in the *Journal of the American Chemical Society*, Professor Sherburn and his team explain how they prepared the molecule as a crystalline metal complex, which is stable because the metal shields the molecule from reaction. It also let the students use an X-ray technique to confirm their structure was correct. With the metal taken away, [5]radialene lives for only minutes — even in very dilute solution at low temperature.

"It was quite a day when the PhD students brought the X-ray crystal structure to me," Professor Sherburn said.



Five-pronged radialene molecules (top left) can be stabilised with metal compounds (lower right). Image credit: Diane Robinson and Michael Sherburn.

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Cancer detection with one drop of blood

A team comprising Swedish, Dutch and US researchers has developed an RNA test of blood platelets that can be used to detect cancer. By analysing a sample equivalent to one drop of blood, the researchers were able to identify, classify and pinpoint the location of the cancer with impressive accuracy.

Writing in the journal *Cancer Cell*, the team explained that tumour-educated blood platelets (TEPs) are implicated as central players in the systemic and local responses to tumour growth, thereby altering their RNA profile. Through the mRNA sequencing of 283 platelet samples, the researchers were able to determine the diagnostic potential of these TEPs.

Of the 283 individuals studied, 228 people had some form of cancer and 55 showed no evidence of cancer. By comparing the blood samples RNA profiles, researchers could identify the presence of cancer with an accuracy of 96% among patients. Among the 39 patients in the study in which an early detection of cancer had been made, 100% of the cases could be identified and classified.

In follow-up tests using the same method, researchers could identify the origin of tumours with an accuracy of 71% in patients with diagnosed cancer in the lung, breast, pancreas, brain, liver, colon and rectum. The samples could also be sorted in subdivisions, depending on molecular differences in the cancer form, which can be of great use in the choice of treatment method.

"We have studied how a whole new blood-based method of biopsy can be used to detect cancer, which in the future renders an invasive cell tissue sample unnecessary in diagnosing lung cancer, for instance," said study co-author Jonas Nilsson, a cancer researcher at Umeå University.

"In the study, nearly all forms of cancer were identified, which proves that blood-based biopsies have an immense potential to improve early detection of cancer."

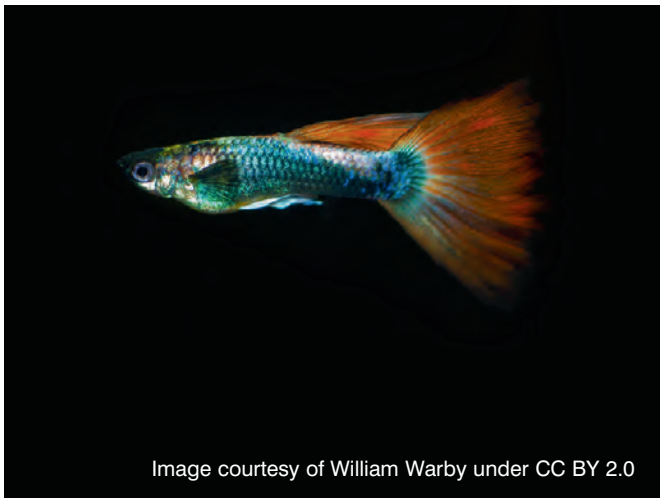

Image courtesy of William Warby under CC BY 2.0

So guppies can count

Australian and Italian researchers have discovered that the humble guppy may be smarter than other fish, with strongly lateralised brains that give them the ability to count. Their study has been published in the journal *Frontiers in Behavioural Neuroscience*.

Scientists have often wondered why humans and other animals have lateralised brains, where the two halves of their brain execute different functions. One theory suggests that having strongly lateralised brains allows each hemisphere to analyse information separately.

"It's a bit like having a dual processor in a computer," explained Associate Professor Culum Brown from Macquarie University, a co-author on the study. "Obviously information processing is far more efficient and faster if two processors can independently analyse two different sources of information simultaneously."

Professor Brown and his colleagues from the University of Padova conducted a study in which guppies were sorted into left, right and non-lateralised groups using a standard mirror test. Their numerical discrimination abilities were then tested in both natural shoal choice and abstract contexts.

"Our experiments show that fish with strongly lateralised brains could differentiate between three versus four objects, both in natural and artificial contexts, whereas those with non-lateralised brains could only differentiate two versus three," Professor Brown said. Keeping track of objects containing four items seems to be the upper limit of most animals; after this, animals (including humans) switch to an alternative system that relies on ratios when comparing sets.

Professor Brown noted that there are lots of reasons why it might be important for animals to keep track of objects or accurately compare sets. For example, "When faced with a predator, guppies must choose the largest shoal to join because there is safety in numbers," he said.

The results suggest that animals with strongly lateralised brains would have an advantage in these contexts and may well explain why other animals, like humans, have evolved lateralised brains.

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Rustproof alloy discovered accidentally

Researchers have discovered a rustproof, ultralight alloy that could lead to improved fuel efficiency and reduced greenhouse gas emissions. The magnesium-lithium alloy weighs half as much as aluminium and is 30% lighter than magnesium, making it a suitable candidate to replace commonly used metals in vehicles.

Most excitingly, the high-strength alloy forms a protective layer of carbonate-rich film on exposure to air, making it immune to corrosion. This corrosion resistance was observed by chance, when a team comprising UNSW and Monash University researchers noticed a heat-treated sample from a Chinese aluminium-production giant, CHALCO, sitting inert in a beaker of water in their laboratory.

"This is the first magnesium-lithium alloy to stop corrosion from irreversibly eating into the alloy, as the balance of elements interacts with ambient air to form a surface layer which, even if scraped off repeatedly, rapidly reforms to create reliable and durable protection," said Professor Michael Ferry, from UNSW's School of Materials Science and Engineering.

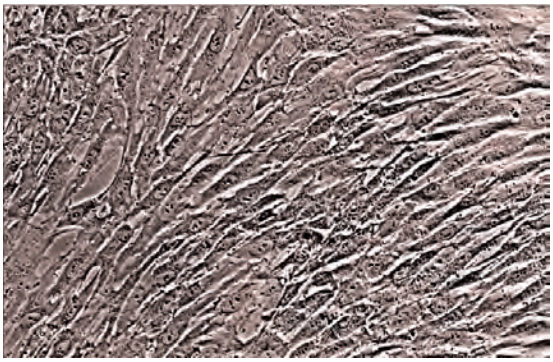
The team partnered with scientists on the powder diffraction (PD) beamline at the Australian Synchrotron to confirm that the alloy contains a unique nanostructure that enables the formation of a protective surface film. The results of their study have since been published in the journal *Nature Materials*.

The researchers have now turned their attention to investigating the molecular composition of the underlying alloy and the carbonate-rich surface film, to understand how the corrosion process is impeded. Professor Nick Birbilis, from the School of Materials Science and Engineering at Monash University, said viewing unprecedented structural detail of the alloy through the Australian Synchrotron will enable the team to work towards commercialising the new metal.

"We're aiming to take the knowledge gleaned at the Australian Synchrotron to incorporate new techniques into the mass production of this unique alloy in sheets of varying thickness, in a standard processing plant," Professor Birbilis said.

"These panels will make many vehicles and consumer products much lighter and, eventually, just as durable as today's corrosion-resistant stainless steel."

The research team also includes researchers from CHALCO and Nanjing Tech University in China.



Lonza's enhanced human MSCs

Life science company Lonza has enhanced its range of Poietics human bone marrow-derived mesenchymal stem cells (hMSCs) by expanding the characterisation of the cells to meet industry guidelines for translational and cell therapy research applications.

The enhanced Poietics hMSCs help to ensure that researchers commence their experiments with a high-quality starting population of multipotent stem cells. This robust starting population is important for translational research and a number of other applications where stem cells can play a vital role, including gene therapy and transplantation, cell differentiation and cell-based screening assays (such as those commonly employed in drug discovery labs).

"Ensuring our hMSCs meet industry guidelines is absolutely essential for the cutting-edge research our customers perform," said Dr Minh Hong, marketing manager for Stem Cells at Lonza Bioscience Solutions. "The improved characterisation of our hMSCs provides end users with confidence when utilising our cells and represents our ongoing commitment to developing the best tools for stem cell researchers."

hMSCs are useful cells because of their versatility. They are capable of replication as undifferentiated cells and can also differentiate into bone, cartilage, fat, muscle, tendon and marrow stroma. Poietics hMSCs are quality tested to differentiate into adipogenic, chondrogenic and osteogenic lineages when cultured in the recommended differentiation medium.

In accordance with the 2006 International Society for Cellular Therapy criteria, the hMSCs are also now tested to ensure the expression of CD90 and CD73, as well as confirming the absence of HLA-DR and CD19. The cells also express CD29, CD44, CD105 and CD166, and do not express CD14, CD34 or CD45.

All cells are free from mycoplasma, bacteria, yeast and fungi, and all donors and/or cell lots test negative for HIV-1, hepatitis B and hepatitis C. In addition, a certificate of analysis is provided for each cell lot purchased.

The improved hMSCs are part of a portfolio of cell culture products that form a streamlined workflow specifically optimised to deliver accurate results, encompassing Lonza's primary adult stem cells, growth and expansion media, differentiation kits and cell-based assays.

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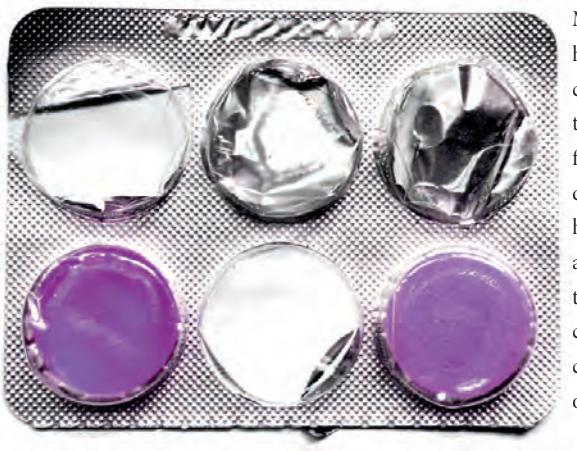
Merck and Selvita collaborate on drug discovery



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Merck's healthcare business has entered into a three-year collaboration to validate new therapeutic concepts in the field of oncology with drug discovery company Selvita, headquartered in Poland. The aim of the collaboration is to deliver potential first-in-class small molecules as lead candidate drugs for multiple oncology indications.

The collaboration will steer a joined portfolio of discovery projects in a risk/reward sharing model and builds on the framework that the two companies have developed during a two-year partnership in cancer metabolism which began in 2013. Both companies will contribute funding and resources, as well as bring their expertise in target validation, bioinformatics, medicinal chemistry, in vitro and in vivo biology and toxicology.

Merck will have an exclusive licence to the joint intellectual property and Selvita will receive milestone payments and royalties on successful development and commercialisation of products by Merck. The collaboration consists of a joint research phase up to lead identification, after which Merck will further research and develop the projects on its own.

"Collaboration between Merck and Selvita is an excellent example of a successful joint drug discovery platform where both parties contribute their expertise to identify and validate novel therapeutic targets, in parallel developing new compounds and advancing them towards clinical development," said Selvita Chief Scientific Officer Krzysztof Brzozka.

IDT to acquire AITbiotech

Integrated DNA Technologies (IDT), a provider of synthetic nucleic acids for molecular biology applications, has entered into a definitive agreement to acquire the oligonucleotide synthesis business of AITbiotech — a Singapore-based company that provides a complete suite of genomics services to research, healthcare and biomedical industries in Asia.

The acquisition will see IDT expands its customer base across South-East Asia, making it possible for these additional customers to have access to the company's broad range of products for genomic applications. AITbiotech will continue operations in its other core business areas.

"With this purchase, we further expand our presence in the region and look forward to welcoming AITbiotech customers to IDT," said IDT founder and CEO Dr Joseph A Walder. "The entire Singapore scientific research market can now benefit from IDT's unrivalled manufacturing capabilities, design expertise and fast turnaround times."

AITbiotech's founder and CEO, Alex Thian, added, "We share a commitment with IDT to produce consistently high-quality oligos and to provide personal service for customers. Both companies are working diligently to facilitate a smooth transition of the business and we are excited to begin this next chapter in the ever expanding Singapore market."

New chair of Innovation Australia appointed

Minister for Industry, Innovation and Science Christopher Pyne has announced Bill Ferris AC as the new chair of Innovation Australia.

Innovation Australia was established by the government to enhance Australia's innovation performance. As chair of the independent body for the next three years, Ferris will perform a key role in the Australian Government's new focus on innovation.

"Mr Ferris is the right person to lead Innovation Australia in developing a more innovative culture," said Pyne. "A former chair of Austrade and for 12 years the chair of the Garvan Institute of Medical Research, Bill is a highly respected veteran of venture capital and private equity in Australasia.

"He has extensive experience in the venture capital field and founded Australia's first venture capital firm in the 1970s. Bill has been a key adviser as we develop the Innovation and Science Agenda, and will continue to be so as we work to implement it."

A 45-year veteran of private equity in Australasia, Ferris has been the executive chairman of CHAMP Private Equity since its formation in 2000 and of its predecessor, Australian Mezzanine Investments (AMIL), which he co-founded in 1987. He was made an Officer of the Order of Australia in 1990 for services to the export industry and in 2008 was made Companion of the Order of Australia for his philanthropic activities, as a leader in support of medical research and for his role in the establishment of the private equity sector in Australia.

"I have long been a champion of the need for greater government and private sector effort in the commercialisation of our research discoveries and inventions," Ferris said.

"Now with the Prime Minister's and Minister Pyne's expressed determination to make innovation core to the government's economic policies, I relish the opportunity as chair of Innovation Australia to assist in identifying what changes are necessary for meaningful improvement in commercialisation and how to best get on with it right away.

"It is a rare and exciting moment for all involved in science and innovation in Australia; a time to lift national awareness of the importance innovation must play in our future prosperity and the actions necessary for that to be possible."

Single-use bioprocessing fluid path products

Watson-Marlow Fluid Technology Group has announced its complete range of single-use bioprocessing fluid path products, which eliminate cross-contamination risks and provide a fast time to market.

Watson-Marlow products provide security, accuracy and purity for all upstream and downstream fluid handling needs — from pilot scale to full production — all with the same materials and the same software. With the company's single-use bioprocessing fluid path solutions, the process remains controlled and repeatable without changing contact materials or losing performance, all while minimising validation requirements.

Whether performing pH control or gentle transfer of live cells, the company covers every step in the process — including media preparation, buffer preparation, fermentation, harvest, purification and fill/finish. All the products feature high-purity, USP Class VI fully validated contact materials and are available with short delivery times.

In continuous daily use throughout the bioprocessing industry, Watson-Marlow peristaltic pumps provide flow accuracy, ensuring process stability, current good manufacturing practice (cGMP) compliance and final product quality. The unimpeded flow path and good junction strength provided by the pumps and tubing, coupled with BioPure fluid path connectors and Flexicon liquid filling, reduces process variation, enhance operating techniques and increase product quality.

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

Chromogenic media

Carbapenem-resistant ***Enterobacteriaceae*** (CRE) are usually resistant to all β-lactam agents, as well as most other classes of antimicrobial agents. The treatment options for patients infected with CRE are very limited, and healthcare-associated outbreaks of CRE have been reported. Identifying patients who are colonised with CRE, and placing these patients in isolation, may be an important step in preventing transmission.

CHROMagar has developed a highly sensitive chromogenic medium, CHROMagar mSuperCARBA, which is suitable for the detection of gram-negative bacteria with a reduced susceptibility to most of the carbapenem agents. The product can detect of a large variety of carbapenemases — including KPC, NDM, VIM, IMP and OXA — with an impressive limit of detection (10 CFU/mL) even for weakly expressed carbapenemases like OXA-48, while maintaining a high level of selectivity.

Dutec Diagnostics Pty Ltd
www.dutecdiagnostics.net.au

Accelerating the search for an HIV vaccine

The European AIDS Vaccine Initiative (EAVI2020) is a €23 million ($30 million) program to speed up the search for an effective HIV vaccine. The program comes in the wake of several recent breakthroughs, including the isolation of antibodies that are able to block HIV infection in preclinical models and new developments in synthetic biology to design better vaccines.

"This project creates a unique opportunity for us to build on the enormous scientific progress gleaned over the last few years, providing an unprecedented insight into the nature of protective antibodies and antiviral cellular response that will be needed for an effective vaccine," said EAVI2020 Coordinator Professor Robin Shattock, from Imperial College London. "We now understand much more about how humans make protective immune responses and how to structure vaccine candidates. We have a level of understanding at a molecular level that was not previously available."

Funded by the European Commission and led by Imperial College London, EAVI2020 brings together a multidisciplinary team of HIV researchers from 22 public organisations and biotech companies from across Europe, Australia, Canada and the USA. The Australian contingent includes Professors David Cooper, Anthony Kelleher and Miles Davenport from the Kirby Institute at UNSW, along with Professors Damian Purcell and Stephen Kent from the Doherty Institute at the University of Melbourne.

"Great advances in science and medicine all need teamwork," said University of Melbourne Professor Sharon Lewin, director of the Doherty Institute.

"This collaboration will allow us to work with the best people, using the best technologies to build on the enormous scientific progress that has been gleaned over the last few years.

"We'll be taking the latest discoveries from the lab through to preclinical testing and manufacture and into early human trials more quickly than we could ever do in isolation from each other."

While the Australian scientists work on creating an effective HIV vaccine in their own laboratories (see below), Imperial College London researchers will be looking at how healthy human volunteers' immune systems respond to potential vaccines, studying the antibodies that the volunteers produce. They will then explore the pathways in the body that make these antibodies in order to fine-tune candidate vaccines.

The International AIDS Vaccine Initiative (IAVI) will meanwhile provide product development support to help the consortium's vaccine candidates advance through clinical assessment. The IAVI Human Immunology Laboratory, a partnership with Imperial College London, will be one of the laboratories assessing immune responses induced in EAVI2020's clinical trials.

The program aims to take candidate vaccines into human trials within five years.

New technique developed at Doherty Institute

Doherty Institute researcher Dr Amy Chung has announced her own progress in the journey towards an HIV vaccine, with the creation of a new approach to systematically understanding the immune response to the virus. Termed 'Systems Serology', the technique was developed by Dr Chung in conjunction with researchers at the Ragon Institute of MGH, MIT and Harvard in the USA.

Systems Serology is a combined experimental and computational analytical method that effectively teases out the complex immune response needed for an effective HIV vaccine. According to Dr Chung, the technique provides an unprecedented depth of understanding to these potentially protective immune responses.

"Antibodies are a key part of protection against viruses like HIV," she said. "They can harness a variety of different 'weapons' to eliminate the virus. But the exact immune responses or combinations to induce protective immunity against HIV are still unclear.

"Using Systems Serology we revealed unique, vaccine-induced antibody 'fingerprints', which highlighted known and novel markers of what is needed to protect a person from becoming infected with HIV."

The new technique has been described in the paper *Cell* and, according to Professor Lewin, could lead to "identifying the exact combination of immune responses required to eliminate HIV transmission through vaccination".

Prevent the Unexpected

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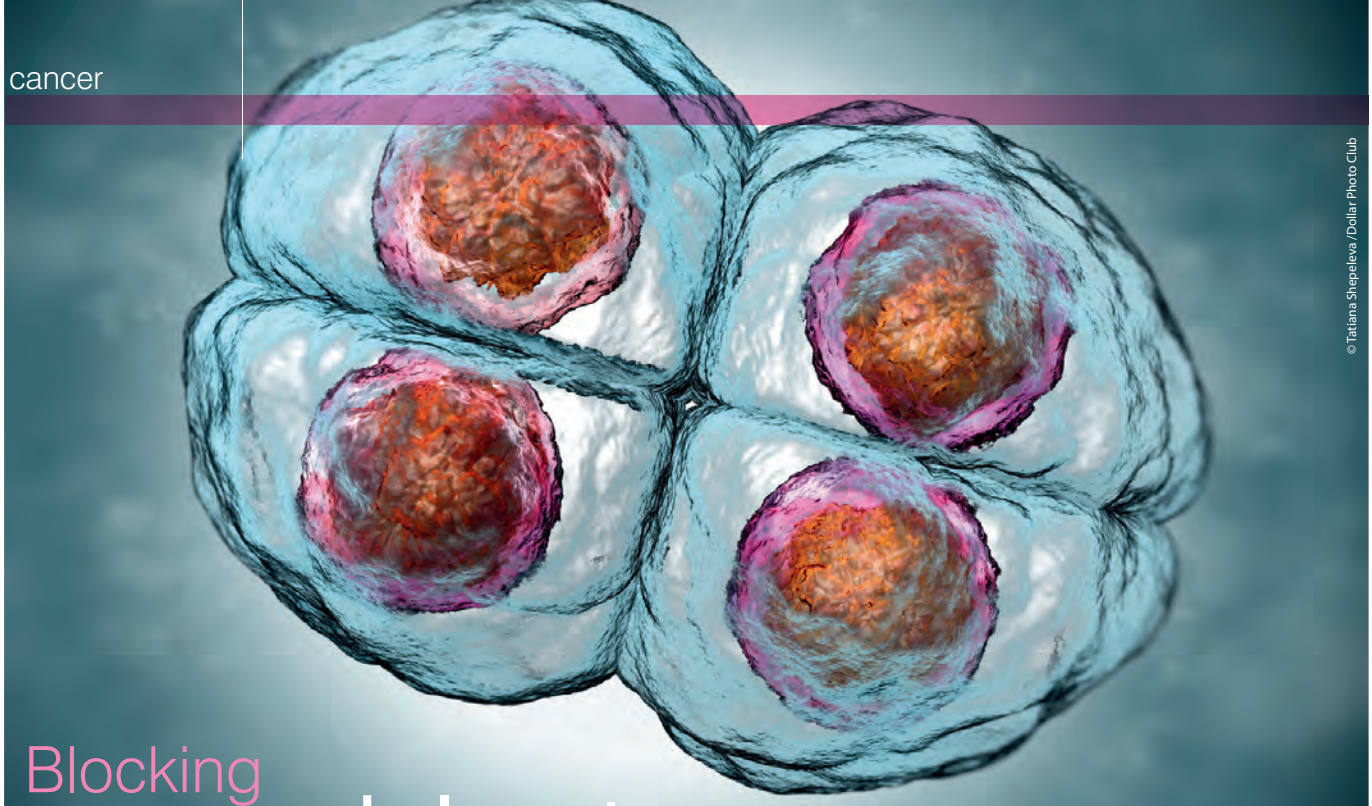


Blocking neuroblastoma

In a study led by the Children's Cancer Institute, scientists have identified a critical molecular 'feedback loop' that helps initiate and drive neuroblastoma — as well as a drug that has the potential to stop it.

Neuroblastoma is a cancer of the nervous system in children that is triggered in embryonal nerve cells. It is the most common 'solid tumour' of early childhood and is generally diagnosed when the disease is advanced. Around half of all children with neuroblastoma have aggressive tumours, and fewer than half of these patients survive.

The new study found that an experimental drug known as CBL0137, used in combination with traditional DNA-damaging chemotherapy agents, was much more effective than either drug alone. This was because CBL0137 created a 'synthetic lethal' state by preventing the cancer cells from repairing DNA damage induced by chemotherapy, and so ensuring cell death.

The authors also showed in laboratory models of neuroblastoma that the drug could block the very start of the embryonal cancer, paving the way to possible prevention strategies in the future. Their study has been published in the journal *Science Translational Medicine*.

Children's Cancer Institute researchers Dr Daniel Carter and Professor Glenn Marshall focused on the genetic and molecular mechanisms behind the feedback loop, which would normally accelerate cancer development, and its interruption by CBL0137. The feedback loop involves the *MYCN* gene — already known to be a key driver of neuroblastoma — and a molecule known as FACT, a DNA modifying agent, which is the target of CBL0137.

The Marshall laboratory demonstrated in neuroblastoma cells that FACT not only upregulates the expression of the *MYCN* gene, but it also prolongs the life of the MYCN protein (the product of the *MYCN* gene). They found that MYCN directed neuroblastoma cells to produce more FACT, which in turn forced the MYCN levels ever higher, thus driving the cancer.

"We showed that maintenance of high MYCN protein levels is a key issue for this *MYCN*-driven cancer," said Professor Marshall. "Neuroblastoma cells often have over 100 copies of the *MYCN* gene, so they produce an enormous amount of MYCN protein.

"Yet in addition to the very high levels of MYCN protein, the cancer cells have tools to stop that protein being broken down. That says to me 'here's a very good treatment target — it must be the Achilles heel of the cancer'."

In the embryo, *MYCN* helps guide the normal development of the sympathetic nervous system by directing the division and migration of primitive nerve cells. At some point in the process, *MYCN* is switched off and excess cells die off. Neuroblastoma arises when the *MYCN* gene is not switched off — and some cells continue to divide and proliferate after birth.

Professor Michelle Haber, Professor Murray Norris, Dr David Ziegler and Jayne Murray meanwhile focused on the therapeutic potential of CBL0137, both as a single agent and in combination with other drugs. Not only was CBL0137 found to be very effective against the most aggressive neuroblastomas, but in contrast to other chemotherapeutic agents, it does not damage DNA.

"The drug is currently in Phase 1 clinical trials for adults, which means that safe dosage levels are being tested," said Professor Haber. "Once the adult trials are completed, a Phase 1 trial for children with refractory — or relapsed — neuroblastoma, and also other aggressive childhood cancers, will open in the United States and Australia."

For CBL0137 to be effective at preventing neuroblastoma, it would have to be safe enough to be given to all children at birth. Professor Marshall explained, "You would give it once or twice to a newborn, as you give vitamin K, as a way of killing off excess cells that should have died prior to birth."

The next phase of this project will be a clinical trial of CBL0137 in children at children's cancer centres in the United States and at Sydney Children's Hospital, Randwick, conducted through the US-based Children's Oncology Group (COG). The clinical trial in both countries will be led by Dr David Ziegler, a senior researcher at the Children's Cancer Institute and head of clinical trials at the Kids Cancer Centre, Sydney Children's Hospital.

Rheological testing of complex fluids and soft solids

The Malvern Kinexus rheometer incorporates innovations and measurement geometries that enable optimal flexibility in rheological test capabilities. Complex fluids and soft solids, including dispersions, emulsions, polymer and surfactant solutions, pastes and gels, can be characterised and their rheological properties measured using customised tests with minimum user effort.

The software uses SOP-driven tests for consistent testing. It actively guides the user through setting up the correct system configuration, which means less time learning and more time characterising samples. Geometry recognition and auto-configuration ensures that the required standards are met for routine QC testing through to research.

The rheometer's High Temperature Cartridge (0 to 300°C) is an easily interchangeable environmental controller that enables temperature control of applications from fluids through to soft solids, thermoset composites and polymer melts. The Peltier Cylinder Cartridge can meanwhile be used with the Torsion/DMA system to allow testing of a rectangular or cylindrical solid sample in a dry or wet temperature-controlled environment. This allows the user to measure rheological changes that a sample might undergo when in contact with a fluid (eg, asphalt core surrounded by gasoline).

ATA Scientific Pty Ltd
www.atascientific.com.au

Water purification system

The Autwomatic Plus 1+2 water purification system from Wasserlab offers users the option of Type I, Type II or Type III water from the same machine.

Type II water is produced using reverse osmosis, deionisation and UV treatment. As an intermediate step, osmotised water is stored in a pressurised tank to prevent uptake of CO_2. Type I and II water is produced instantaneously on demand from the osmotised storage tank.

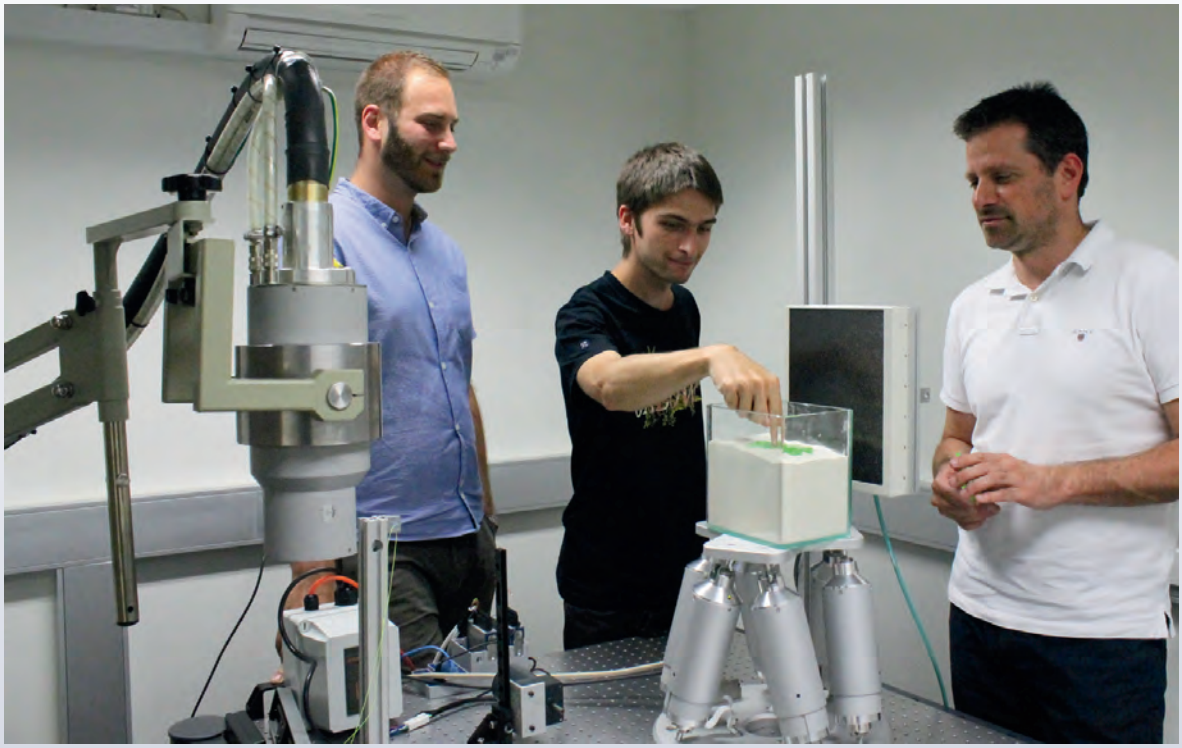
The production rate of Type I water is 1.1 L/min. Ultrafiltration of the Type I water is available as an option for applications requiring endotoxin control (PCR, molecular biology, cell culture, sequencing, MAP).

All parameters are constantly monitored and controlled via an 11 cm touch screen. Replacement of cartridges is simple using a drip-free, quick-connect mechanism.

Other purification systems are also available from Wasserlab.

Capella Science
www.capellascience.com.au

Solving the mysteries of granular materials flow



Dr Benjy Marks, Dr François Guillard and Professor Itai Einav studying granular flow using custom X-ray equipment.

Professor Itai Einav runs the Sydney Centre in Geomechanics and Mining Materials (SciGEM) at the University of Sydney — a research facility specialising in geomechanics and granular physics. This involves the study of the motion of granular materials such as soil and rock and their interaction with obstacles — an area of technology which is highly relevant to geotechnical engineering and ensuring the stability of buildings and other structures.

In their laboratories, Professor Einav and his researchers use experimental, theoretical and computer program models to predict how granular materials behave under various conditions. Their work has relevance to areas such as silo flow, conveying of grains and powders, hang-up delays in block cave mining, mixing and segregation in tumbling mills and rotating drums, and segregation of drugs in pharmaceutical powder compactions.

To test their theoretical models, the team has built a range of test rigs to demonstrate different flow and movement scenarios. These set-ups allow them to test and model scenarios such as inclines, conveyors, silos, etc. They have even constructed what is said to be the world's first facility for microanalysis of granular flow.

But while the team has been able to translate certain methodologies across from previous experiments, they needed to move away from reflected light to give a deeper understanding of how materials flow under given conditions. The logical choice was to use X-rays, which can provide a detailed 2D picture of what is going on. Professor Einav called on the expertise of AXT, a company with a long history in X-ray equipment and technologies. Together, they designed a custom solution incorporating X-ray source, high-voltage power supply, digital flat panel detector and other ancillary items sourced from AXT's suppliers.

The hardware supplied by AXT has been seamlessly integrated with software and models developed by Professor Einav's researchers, who can monitor fast-flowing dry granular materials. The system is said to work so well that they have decided to look at larger, more complex systems. This requires an extension to the existing set-up, with an identical system to be configured orthogonally to the original one. This will allow them to capture detailed 3D images so they can more accurately model real-life systems, giving their research more applied applications and relevance. This new capability will give Professor Einav's team the ability to track individual particle motions within larger bodies of flowing particles.

"The addition of this extended capability is fully expected to give us new insights to help us prove or debunk many of the theories that have been postulated relating to materials flow," Professor Einav said. "As a result, we expect to make significant advances in the areas such as turbulence and segregation in granular flows, interactions between particles and flexible intruders in soils and the motion of fluids in porous networks."

AXT Pty Ltd
www.axt.com.au

Pipettor range

The Nexty pipettor range is designed to fit comfortably in the user's hand. Pipettor volumes from 0.2 up to 5000 µL are available, all with easily recognisable push-button colour codes. There are three models available — fixed volume, variable volume and multichannel — ensuring there is a product to suit every application.

The variable volume and multichannel pipettors feature an easy-to-read three-digit indicator (volumeter) display. This makes settings quick and efficient during busy procedures. The lower portion nose-cone and eject-cone can be taken off and autoclaved to help ensure cleanliness and accuracy.

Each of the eight channels in the multichannel model has independent suspension to ensure accurate tip insertion and help apply equal pressure reducing tip fitting errors. The large mushroom-shaped push-button reduces repetitive stress on the thumb and a spring system means a light stroke is required to use the pipettor.

The Nexty range is manufactured in a dedicated controlled environment according to ISO8655 standards. The pipettors have a one-year guarantee and every unit ships with an accuracy inspection report and product warranty. Accessories include the pipettor carousel stand to hook and secure up to six pipettors and a wide range of tips.

Thermoline Scientific Equipment Pty Ltd
www.thermoline.com.au

Your fingerprint

can reveal whether you're male or female

Researchers from the University at Albany (UAlbany) are taking crime scene investigation to a new level with the discovery that our fingerprints can be used to identify whether the print belongs to a male or a female.

Writing in the journal *Analytical Chemistry*, the researchers explained that fingerprint identification over the past 100 years or so has relied mainly on pictorial comparisons. "Despite developments to software systems in order to increase the probability and speed of identification, there has been limited success in the efforts that have been made to move away from the discipline's absolute dependence on the existence of a prerecorded matching fingerprint," they wrote.

The UAlbany research team, led by Assistant Chemistry Professor Jan Halámek, took a different approach, instead looking at the content present in the sweat left by fingerprints — namely, the amino acids. They relied on the fact that amino acid levels in the sweat of females are about twice as high as in males. There's also a slightly different distribution, due mostly to hormonal differences. They therefore sought to test whether the same was true true for amino acids left behind in fingerprints.

First, Halámek's team extracted amino acids from a fingerprint by transferring it onto a piece of plastic wrap. A hydrochloric acid solution was placed onto the fingerprint, followed by heating. This process allowed for the water-soluble amino acids to migrate into the acidic solution. From there, the team could easily view amino acid levels, distinguishing sex.

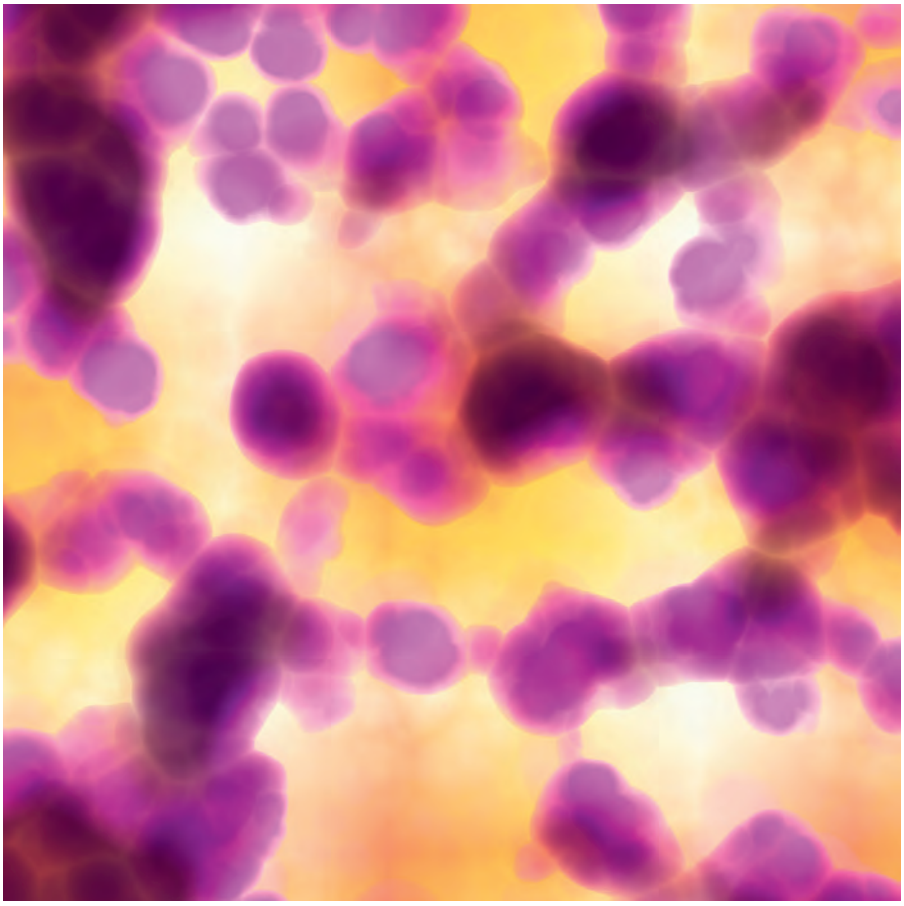
The team first tested their method on 'mimicked fingerprint samples', which they found to be 99% accurate in correct sex classification. From there, they set up a real crime scene scenario. Three female volunteers placed their fingerprints on five different surfaces, including a doorknob and a computer screen. Regardless of the surface type, Halámek's team found it was possible to tell the fingerprint belonged to a woman.

"We were able to focus on the biochemical content in the fingerprint using a biocatalytic assay, coupled with a specially designed extraction protocol, for determining gender rather than focusing solely on the physical image," the researchers wrote.

According to Halámek, this is only the beginning. He's currently in the process of developing additional identification methods for other forensically relevant attributes, as well as improving on the current fingerprint concept.

"One of the main goals for this project was to move toward looking at the chemical content within the fingerprint, as opposed to relying on simply the fingerprint image," Halámek said. "We do not intend to compete with DNA analysis or the databases used for identification. Instead we are aiming at differentiating between demographic groups, and more importantly, we are aiming at making use of fingerprints that are smudged/distorted or that don't have an existing match."

Graeme O'Neill



Tribulations of Tribbles

Australian and New Zealand leukaemia researchers have used the Australian Synchrotron in Melbourne to solve the 3D structure of a key protein involved in the development of leukaemias and certain other cancers.

A Star Trek fan holding a Tribble. Image courtesy of Nathan Rupert under CC BY-NC-ND 2.0

The protein, Trib1, belongs to an enigmatic class of proteins known as pseudokinases.

One of the study's authors, Dr James Murphy of the Walter and Eliza Hall Institute for Medical Research (WEHI) in Melbourne, said the detailed 3D structure is an important step towards designing a novel, small-molecule drug for some leukaemias.

Overexpression of Trib1 is a disease marker in patients with acute myeloid leukaemia. AML is one of the most aggressive and therapeutically intractable forms of leukaemia; it is characterised by uncontrollable proliferation of immature white blood cells.

Dr Peter Mace, of the University of Otago in New Zealand, was the lead investigator on the Trib1 research project. Dr Murphy and WEHI colleague Dr Isabelle Lucat were co-authors on the paper, which was published in the journal *Structure*.

Drosophila geneticists named Tribbles-1 after small, furry aliens in the popular TV science-fiction drama *Star Trek* who proliferate uncontrollably, consuming resources at an exponentially increasing rate.

According to Dr Murphy, pseudokinases were half a decade ago the subject of a "raging debate" over whether they were true kinases. Structurally, they resemble degenerate kinases — specialised enzymes that catalyse the activation of other proteins with a high-energy 'kiss' that transfers a phosphate molecule to the target protein.

"Some pseudokinases have been shown to have unconventional catalytic mechanisms — for a long time, it was contentious as to whether they were truly catalytic," Dr Murphy said.

Geneticists subsequently identified human and mouse homologs of Tribbles-1 in Drosophila — but it was unclear whether the contorted structure of the Drosophila mutant in the human and mouse homologs was conserved in such distantly related species as mice and man.

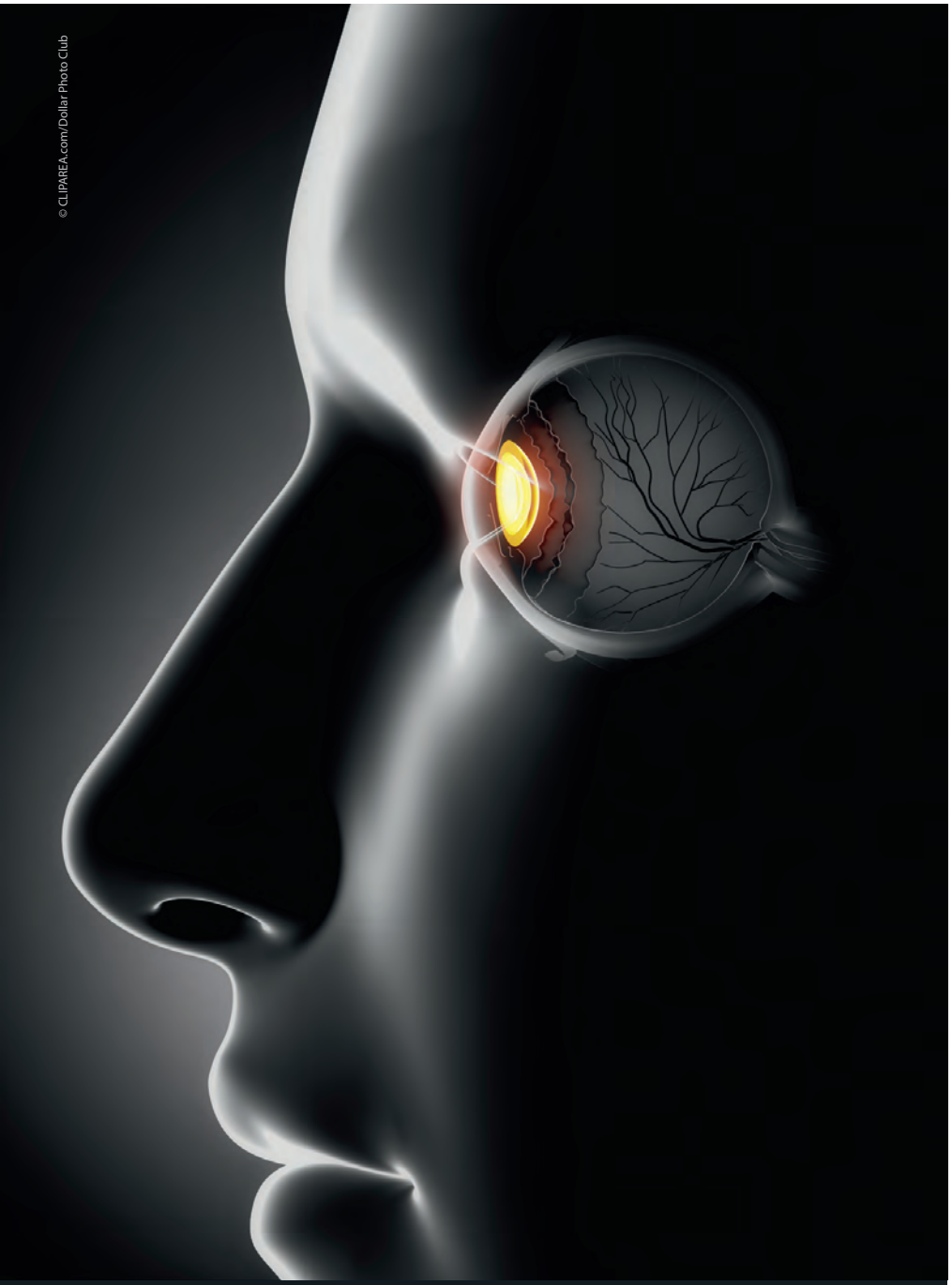
Dr Murphy said the synchrotron's detailed, 3D solution confirmed that it is — the human Tribbles-1 protein has the same, contorted structure of the Drosophila protein.

Tribbles-1 is classed as a pseudokinase because the normal form of the protein lacks the classic leucine residue that normally resides within the catalytic site of leucine kinases, but Dr Murphy said an atypical leucine that resides nearby may get the job done.

According to Dr Mace, Trib1 acts as a scaffold to bring many proteins together, forming a large complex that caused specific proteins to be degraded.

"As well as explaining how Trib1 functions, our research could help us design novel therapeutic agents for the treatment of AML," he said. "For example, some AML patients have too much Trib1, which causes a loss of proteins that would normally inhibit cancer. Understanding the structure of Trib1 provides critical clues about how we could block Tribbles for the treatment of AML."

Graeme O'Neill



Could we kill two diseases with one campaign?

British researchers have proposed that the World Health Organization's planned mass treatment campaign to eradicate the tropical disease yaws from the planet by 2020 should be integrated with a WHO-led project to eliminate another common disease of the world's poor — trachoma — with the same deadline.

Yaws, which affects skin, bone and cartilage, no longer exists in Australia, but trachoma — commonly known in Australia as 'sandy blight' — remains a leading cause of blindness and vision problems among Indigenous Australians, particularly those living in remote communities.

The common element to the two programs is the antibiotic azithromycin, which is on the WHO's List of Essential Medicines. It is highly effective against the causative agent of yaws, the spirochaete bacterium *Treponema pallidum ssp pertenue*, and against the intracellular bacterium that causes trachoma, *Chlamydia trachomitis*. In 2010–2011, a randomised trial in Papua New Guinea demonstrated that a single dose of azithromycin was at least as effective as an intramuscular penicillin injection in curing yaws.

A discussion paper published on 3 December in the journal *PLOS Neglected Tropical Diseases* suggests that the geographic overlap between yaws and trachoma in tropical regions like central Africa and Papua New Guinea offers opportunities for synergies between the yaws and trachoma eradication projects. Dr Anthony Solomon, of the London School of Hygiene & Tropical Medicine, is Chief Scientist to the WHO's Global Trachoma Mapping Project and the lead author on the paper, titled 'Trachoma and Yaws: Common Ground?'.

Renowned Australian eye surgeon Professor Fred Hollows was a leading proponent for eliminating trachoma as part of a broader program for improving eye health in Indigenous Australians. In 1975, Professor Hollows obtained a $1.4 million grant from the Commonwealth Department of Health to establish the National Trachoma and Eye Health Program.

He and wife Gabi spent two years traversing Australia in 4WD vehicles, examining and treating

more than 100,000 Aborigines and Torres Strait Islanders for eye problems. Professor Hollows sought to raise public awareness of the issue, pointing out that 94% of blindness in Indigenous Australians was preventable.

Professor Hollows died of pancreatic cancer in 1993. The Fred Hollows Foundation, led by Gabi Hollows, continues his work.

In 2010, the National Indigenous Eye Health Survey examined 1694 Indigenous children aged between five and 15, and 1189 Indigenous adults from 30 remote and rural communities across Australia, to determine the prevalence of trachoma. The results, reported in the *Medical Journal of Australia*, told an all-too-familiar story: blinding endemic trachoma remains a major public health problem in many Indigenous and Torres Strait Islander communities.

The study, headed by Professor Hugh Taylor of The University of Melbourne, found that many Indigenous communities still have a serious problem with blinding trachoma and trachoma scarring of the eyes. The average infection rate in children was 3.8%, ranging from 0.6% in Indigenous children in major cities to 7.3% in very remote communities. 50% of remote Indigenous communities had an infection rate greater than 5%, the level at which trachoma is considered endemic.

Among adults examined, 15.7% had eye scarring from trachoma, 1.4% had trachomatous trichiasis (TT), or inflammation of the conjunctiva, and 0.3% suffered from corneal opacity (CO) due to trachoma. The highest rate for trachoma scarring in any community was 58.3%; for TT it was 14.6% and for CO it was 3.3%.

The WHO trachoma project holds out the promise of finally realising Professor Hollows' ambition to eliminate trachoma from Indigenous and Torres Strait Islander communities, while Australia's near-neighbour, Papua New Guinea, would be a major beneficiary of both the trachoma and yaws projects.

But Professor Solomon and his colleagues identify several issues that could be encountered in a joint campaign against trachoma and yaws in regions where the diseases are co-endemic.

Where the yaws program seeks to eradicate the disease completely, the trachoma program aims only to reduce the disease to a level where it is no longer a public health problem, not to eliminate it completely. Its stated aim is "the reduction of disease incidence, prevalence, morbidity or mortality to a locally acceptable level".

The paper describes a previous "half-hearted" attempt to eliminate yaws in the 1970s, which was unsuccessful. Attempts to control trachoma with tetracycline ointment in the 1950s were also unsuccessful.

Another potential problem for a joint campaign against yaws and trachoma is that different administration protocols are involved. The recommended azithromycin dosage for yaws is higher and involves a one-off dose, with potential follow-up treatments of individual cases where necessary. The trachoma program, however, will involve annual treatments for every community member for five years.

Cell-free protein synthesis reagent

Cosmo Bio's PUREfrex kit is a reconstituted cell-free protein synthesis reagent based on PURE system technology. The reaction system consists of proteins, ribosomes, amino acids and NTPs. The proteins are necessary for transcription, translation and energy regeneration. The proteins and ribosomes are highly purified individually and assembled together to constitute the protein synthesis system.

To synthesise a protein, just add the template DNA or mRNA encoding the protein of interest into the reaction mixture and incubate for several hours. The reconstituted system works by assembling translation-related factors only. This means the user may adjust the composition of the reaction mixture as they like.

The components of the kit are said to have improved levels of purity. Cosmo Bio has also reviewed the construct of each component for better activity, so all components of the kit have no tags for purification and detection. This enables fusion of the user's protein with any tag.

The system is suitable for the preparation of prokaryotic protein, eukaryotic protein, membrane protein, protein containing disulfide bonds, protein containing unnatural amino acids, etc. Other applications include basic research in protein science (translation, folding of protein after synthesis) and in vitro display (ribosome display, mRNA display).

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

Imaging system

The ImageXpress Micro Confocal High-Content Imaging System offers a combination of speed, sensitivity and flexibility in a turnkey solution. The system lets users capture research-quality images with a wide range of objective lenses, allowing them to work at the resolution appropriate for their biology — including whole organism, thick tissues, 3D spheroid assays and cellular or intracellular events — at the speed expected from widefield screening.

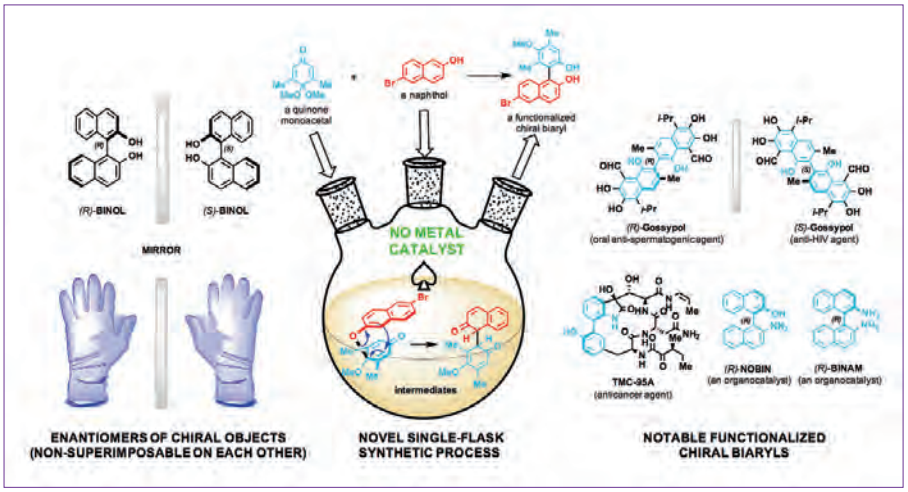
For researchers looking to expand their laboratory's capabilities, the system leverages large field-of-view optics to map macrostructures with minimal tiling. In addition, querying of large cell populations is accelerated, speeding up the characterisation of highly heterogeneous samples or identification of rare subpopulations. Combined with MetaXpress High-Content Image Acquisition and Analysis Software, the product provides users with a complete multidimensional, high-throughput screening solution.

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

Chemical design without metals

Rice University scientists have synthesised dozens of small-molecule catalysts — tools that promise to speed the making of novel chemicals, including drugs — without the use of transition metals. Their research has been published in the journal *Angewandte Chemie*.

The work took place in the lab of Professor László Kürti, where he and his team made elusive chiral biaryl compounds in a single-flask process that does not require the use of conductive metals such as titanium, iron, nickel, silver, copper, palladium and gold. The biaryls are called organocatalysts because they catalyse chemical reactions without metal ions, thus simplifying chemical processes to synthesise new molecules.



Biaryls are molecular compounds of two aromatic rings directly joined by a carbon-carbon bond. When functionalised, or altered, these biaryls (phenyl-phenyl, naphthyl-phenyl, thienyl-naphthyl and more) become highly selective, reliable and customisable catalysts, said Professor Kürti, whose research uses biaryls as catalysts to develop novel single-enantiomer compounds.

Enantiomers are asymmetrical molecules found among organic compounds. Like left and right hands, their structures are mirror images that cannot be superimposed on each other. These twins can have radically different effects — one beneficial, one not — as they interact with enzymes, proteins, receptors and even other chiral catalysts. Pharmaceutical companies want to make drugs that contain only the helpful enantiomer.

Currently, single-enantiomer compounds are synthesised as building blocks for drugs, agricultural products and functional materials. But synthesising one particular enantiomer with precision and high efficiency is hard, especially via trial-and-error approaches that to now often require transition metal catalysts.

"For enantiomer preparations, you need catalysts," Professor Kürti said. But transition metals, commonly used in catalysis, are expensive and can leave toxic residues that need to be removed before the compound can be used in clinical trials.

The Rice lab's simple, cost-effective way to make chiral-functionalised biaryls not only eliminates the need for transition metals, but can replace many steps in the synthesis process — some of which can take days or weeks. The lab combined readily available compounds, including quinone monoacetal and naphthol, to make functionalised biaryls.

"This is a major advance," Professor Kürti said. "Using these building blocks, we made 41 different chiral biaryl compounds in a relatively short time.

"The functionalised chiral biaryls are really versatile compounds. You can use them outright as organocatalysts or complex them with transition metals to make new transition-metal catalysts. So the possibilities are unlimited. Moreover, these compounds can be used as building blocks en route to natural products with biaryl substructures in them."

He said the biaryls lower the barrier to inventing and making new chemical compounds, with potentially huge implications.

"This will certainly find its way into drug discovery, making agrochemicals and many other fine chemicals," Professor Kürti said.

Next-generation sequencing system

QIAGEN has announced the start of commercialisation activities for its GeneReader NGS System, a Sample to Insight next-generation sequencing (NGS) solution that enables laboratories to deliver actionable results. The system offers an end-to-end NGS workflow from primary sample to a final report that provides a simple way for clinical testing to take advantage of NGS technology and improve outcomes.

The first application for the system involves the company's Actionable Insights Tumor Panel. The gene panel targets 12 clinically actionable genes that are often analysed in most prevalent types of cancer, including breast, ovarian, colorectal, lung and melanoma. The panel can detect up to 1250 different genetic mutations in a tumour sample. The most relevant variants have been identified and selected using the QIAGEN Knowledge Base, a collection of human-curated genomic findings and scientific literature.

The system offers laboratories solutions for key challenges in next-generation sequencing. Labs can rely on one partner to provide a seamlessly integrated workflow, offering ease of use and efficiency from sample to insight. Users can create relevant reports using QIAGEN's gene panels and bioinformatics.

Scalable batch sizes and continuous loading of multiple flow cells enable labs to adapt and scale the system to match their needs and grow. Innovative commercial models, such as price-per-insight options, offer labs better cost management and low initial investment hurdles. The company supports users in efficiently implementing, validating and operating the system in their labs.

QIAGEN Pty Ltd
www.qiagen.com

Slide for correlative light and electron microscopy

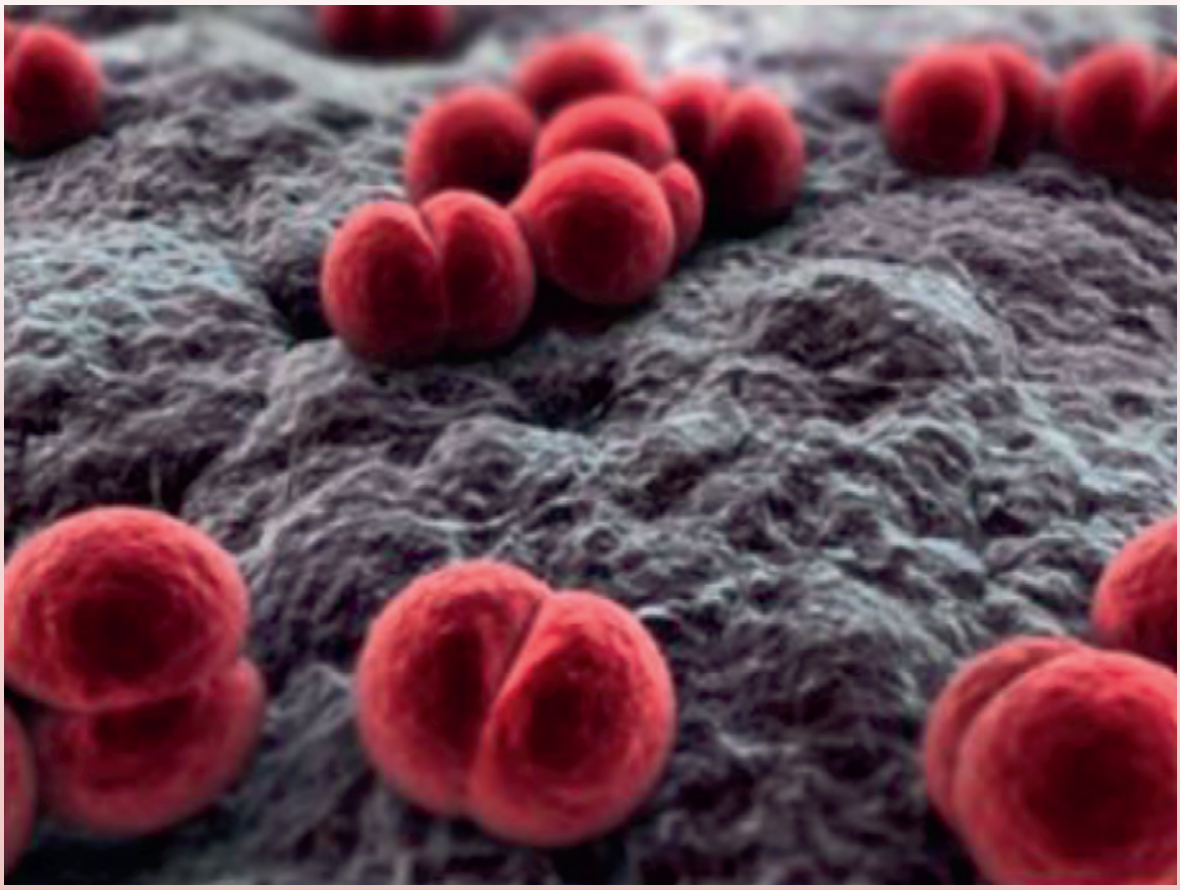
The μ-Slide CorrSight Live correlates the molecular specificity of light microscopy with the high structural resolution of electron microscopy. Live cell imaging, fixation, contrasting and embedding are achieved on one slide.

The special slide consists of three pairs of wells that are connected via perfusion channels for sample perfusion. Each numbered well contains a grid with a 100 μm repeat distance; the grid is clearly visible in phase contrast and electron microscopy.

The ibidi Polymer Coverslip Bottom is resistant to most of the standard chemicals that are used for electron microscopy sample preparation and light microscopy fixation methods.

DKSH Australia Pty Ltd
www.dksh.com.au

Microcalorimetry and meningitis vaccine development



The Neisseria meningitidis protein.

Oxford University researcher Dr David Staunton has recommended the use of differential scanning calorimetry (DSC) as a first-line technique when characterising recombinant proteins.

In a webinar titled 'Application of DSC to structural studies on meningitis vaccines', Dr Staunton reviewed DSC alongside other methods used for protein characterisation, including thermal shift techniques, examining the advantages and limitations of each. He concludes that DSC is a "gold standard in stability characterisation" that should be used first to identify protein melting points and to confirm other techniques and emphasises the importance of fully automated systems in efficient screening.

Describing the use of DSC and other techniques in studies of factor H binding protein (fHbp) as a vaccine candidate for ***Neisseria meningitidis***, Dr Staunton drew on a co-authored paper, published in ***Infection and Immunity***, which examines existing vaccination methods and how efforts have been made to design functionally inactive but immunogenic vaccine candidates, such as fHbp. The authors reported work that included the use of a Malvern MicroCal VP-Capillary DSC system to perform all DSC experiments.

Natalia Markova, principal scientist for MicroCal systems at Malvern Instruments, said: "Since DSC was introduced in the early 1960s, it has found many applications in life science and pharmaceutical development. It is always very exciting to see new application areas such as this one evolving and new methodologies developing."

The Malvern MicroCal VP-Capillary DSC is a highly sensitive, fully automated, high-throughput differential scanning calorimeter. It offers unattended operation for 24-hour working and provides integrated software that is designed to streamline both workflow and data analysis. Consequently, the system delivers results in hours and is said to enable improved productivity in multiple areas of biopharmaceutical research.

The webinar can be viewed on the Malvern Instruments website at http://bit.ly/PR3142Event.

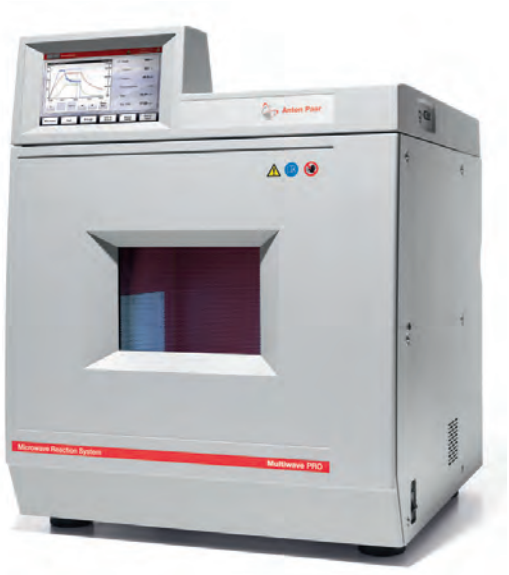
ATA Scientific Pty Ltd
www.atascientific.com.au

Microwave reaction system with software-based automation

Anton Paar's microwave reaction platform, the Multiwave PRO, is receiving a software update. The product is becoming an IoT (Internet of Things) device, enabling users to receive automated notification of completed runs and error reporting via email as well as remotely control the instrument using VNC.

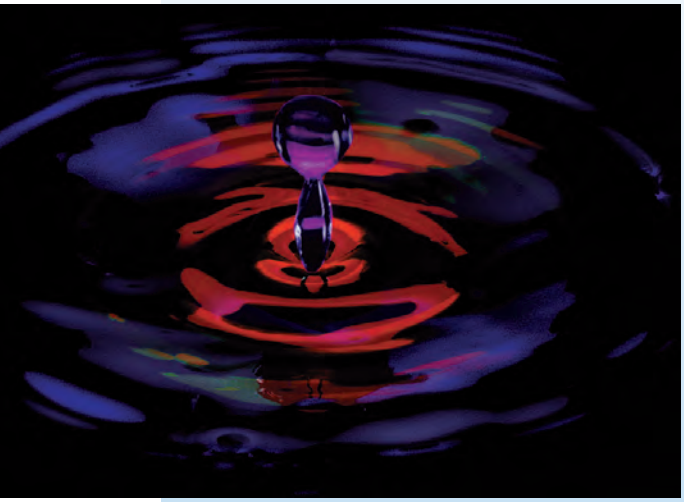
Reducing time to get results in the laboratory is a major concern of laboratory managers. Instruments are getting faster, but the biggest time drain is still the time between analytical steps. Laboratory technicians frequently find themselves waiting for a process to finish or walking back and forth between their desk and an instrument to determine if the process is completed. With the software update, the Multiwave PRO becomes part of the IoT and takes the first step in reducing the time between sample preparation and analysis.

The free update, available on the Anton Paar homepage, builds on the already robust software package used by the reaction system. Current features — such as audio notification and visual notification on the 9″ capacitive touch screen, in addition to a variety of data export capabilities and a comprehensive video manual — make the laboratory microwave platform easy to use.



MEP Instruments Pty Limited
www.mep.net.au

A differential pressure transducer for petroleum core testing



How much oil will come out of an oilfield? Is it worth developing once it is discovered? These are not trivial questions if you must drill and complete your wells in deep water offshore or in the Australian outback.

All of the major oil companies maintain core testing labs, whose job it is to evaluate the oil-producing potential of a given field based on the testing of exploratory oil cores. An oil core is a sample of the oil-bearing rock as obtained from exploratory drilling.

The idea is to subject the recovered core to down-hole temperatures and pressures, then measure the flow of fluids through it. Oil-producing rock typically has the density and porosity of cement, so the study of fluid flow in these materials requires the ability to measure small differential pressures (just a few psi) at very high static pressures (several thousand psi).

The oil core is prepared by fitting it into a special jacket that is heated to down-hole temperature. A special high-pressure pump forces brine through the core. The static pressures around the core are typically 5000 to 10,000 psig.

The core has sealing packers placed along its length at regular intervals. A Validyne DP 303 variable reluctance transducer can be plumbed between the packed-off sections so that the pressure drop through the core rock, as a function of flow rate, can be measured.

A carrier demodulator displays the differential pressure digitally in engineering units. The relationship between flow and pressure drop is a measure of the permeability of the oil-producing formation — this can be used to determine the amount of oil that can ultimately be brought into the well bore from the surrounding rock.

Bestech Australia carries a complete range of Validyne differential pressure sensors. Several of its models have a full scale of little as 5 psi of differential pressure, while both ports of the transducer are at a static pressure of 10,000 psig.

Bestech Australia Pty Ltd
www.bestech.com.au

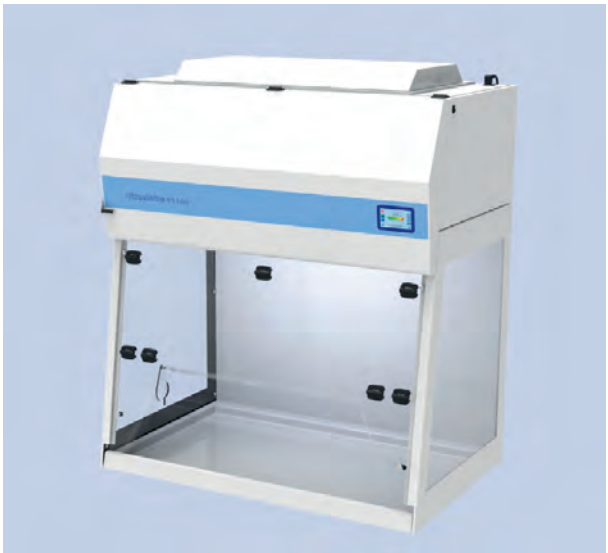
Fume cabinets

The Circulaire range of ductless fume cabinets and clean air solutions is manufactured to the highest international standards by Monmouth Scientific. Each product is vetted and quality controlled by a highly trained team.

The range includes ductless fume cabinets, mobile fume cabinets, spark-proof ductless fume cupboards, downflow workstations, PCR cabinets and laminar flow cabinets, as well as Class II safety cabinets. Some of the products feature the easy-to-use Visionaire 4.3″ full colour touch-screen control system.

The power consumption of the fume cabinets has fallen by 80%. Standard units run from 57 W and at less than 52 dB noise under normal usage, having been fitted with the latest digital fans to ensure low-noise operation and low energy consumption. Energy efficiency is further improved with the use of internal LED lighting, while some models have PIR movement sensors to shut off all non-essential electronic items when the cabinet senses a period of inactivity.

A wide range of carbon filters, HEPA filters and ULPA filters is available. These filters are said to offer a solution for any process being implemented.



Thermoline Scientific Equipment Pty Ltd
www.thermoline.com.au

Portable humidity verification system

Michell Instruments has introduced a portable verification system for humidity probes — the HygroCal100. Weighing just 3.2 kg and with a battery life of up to 8 h, the unit is designed with portability in mind.

The humidity test chamber is stable and enables the evaluation of relative humidity sensors in the range of 5 to 95% RH. Up to seven probes, with different diameters and output signals, can be validated simultaneously. The innovative design allows the probes to be integrated with the chamber and user interface, enabling the operator to easily monitor the readings of each probe during the calibration cycle. All the calibration data can be downloaded from the unit onto a USB drive for later use.

An external reference hygrometer, such as Michell's fundamental, chilled mirror Optidew Vision, can be integrated into the system. If this reference has a traceable calibration, it allows users to incorporate this traceability into their verifications.

The unit is easily programmable through its touch-screen interface, enabling calibration routines to be completely automated. The operator defines the humidity points and time to remain at each of them, inserts the probes and the reference (if used), then leaves the unit to work through the cycle.

The product contains an internal polymer reference, Michell's HS3 sensor, giving ±0.8% RH accuracy. For long-term reliability, the system can be calibrated against an external reference. This is an automatic function: once the reference is connected and the calibration initiated, the product automatically runs through the steps and prompts the user for actions.

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

Concentration technology for volatile samples

Evaporator systems from Genevac can be used to safely prepare samples containing volatile analytes in a wide array of food and beverage applications, ranging from testing constituents of beverages and gluten levels in whisky to pesticide analysis of fruit and vegetables, as well as determining vitamin levels in cereals.

The company's concentration technology has been developed with analytical laboratories worldwide. This, with key technologies like DriPure, ensures that samples are concentrated safely and rapidly. Many food and beverage laboratories have standardised on the Genevac EZ-2 and Rocket evaporators, often in conjunction with Samplegenie technology, because this delivers automation of sample transfer and provides good sample recovery and intertest reproducibility with low standard deviations.

Samplegenie is a suitable aid to concentration because samples can be concentrated directly into the analysis vial. The system detects when the solvent level enters the vial and, once validated, the method will then concentrate the sample to the required level. If a precise volume is required in the vial, the sample can be over-concentrated and then made up to the desired level with pure solvent.

Scitek Australia Pty Ltd
www.scitek.com.au

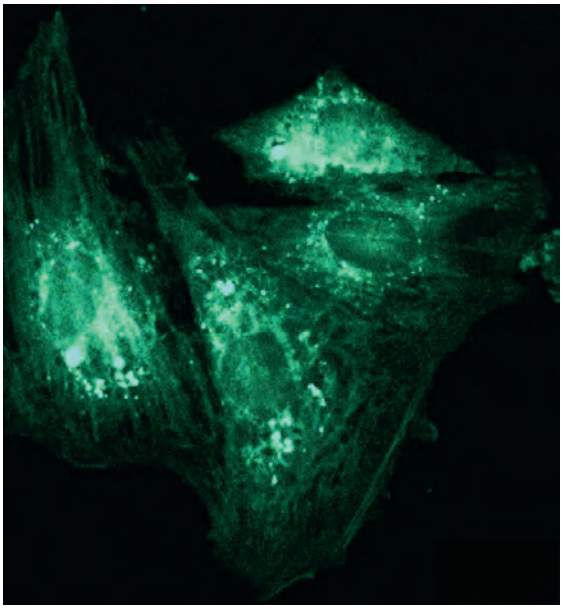
Cell-permeant stain for polar lipids

ReZolve-L1 is a cell-permeant stain that is selective for polar lipids and can be used in a wide variety of live and fixed cells.

The product provides high-quality and rapid lipid staining useful for fluorescent microscopy applications and automated imaging. The stain is an effective tracer of lipid trafficking (eg, cholesterol, sphingolipid and phospholipid) and intracellular localisation.

In live cells, the product acts as a pH sensor enabling more multiparametric application options.

REZOLVE SCIENTIFIC Pty Ltd
www.rezolvescientific.com



Chilled mirror hygrometer

Michell Instruments has redesigned its S8000 Integrale chilled mirror hygrometer to take advantage of improvements in technology since its introduction in 2007. The improvements cover three areas: mechanical design for increased durability and strength, improved sensor head for faster readings at lower dewpoints and increased simplicity of use with a touch-screen interface with intuitive menus.

The S8000 Integrale MKII now includes many of the features found in Michell's S8000 RS chilled mirror instrument. Its sensor head design features improved integrity and sealing mechanisms. This means the product has a faster response to -60°Cdp, improved sensitivity and faster reaction to transient dewpoint conditions. The pressure rating of the instrument has improved from 17 to 20 barg and the unit still has the same accuracy of ±0.1°Cdp.

As well as being more durable and resistant to scratches, the casing now facilitates easier access for maintenance — there are just four screws to remove rather than 18 on the previous model. The full-colour touch-screen interface is intuitive and makes the instrument both easy to use and interrogate.

Typical applications include high-precision moisture measurements in metrology laboratories and cleanrooms, as well as industrial applications such as environmental control in engine testing.

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

COD analyser

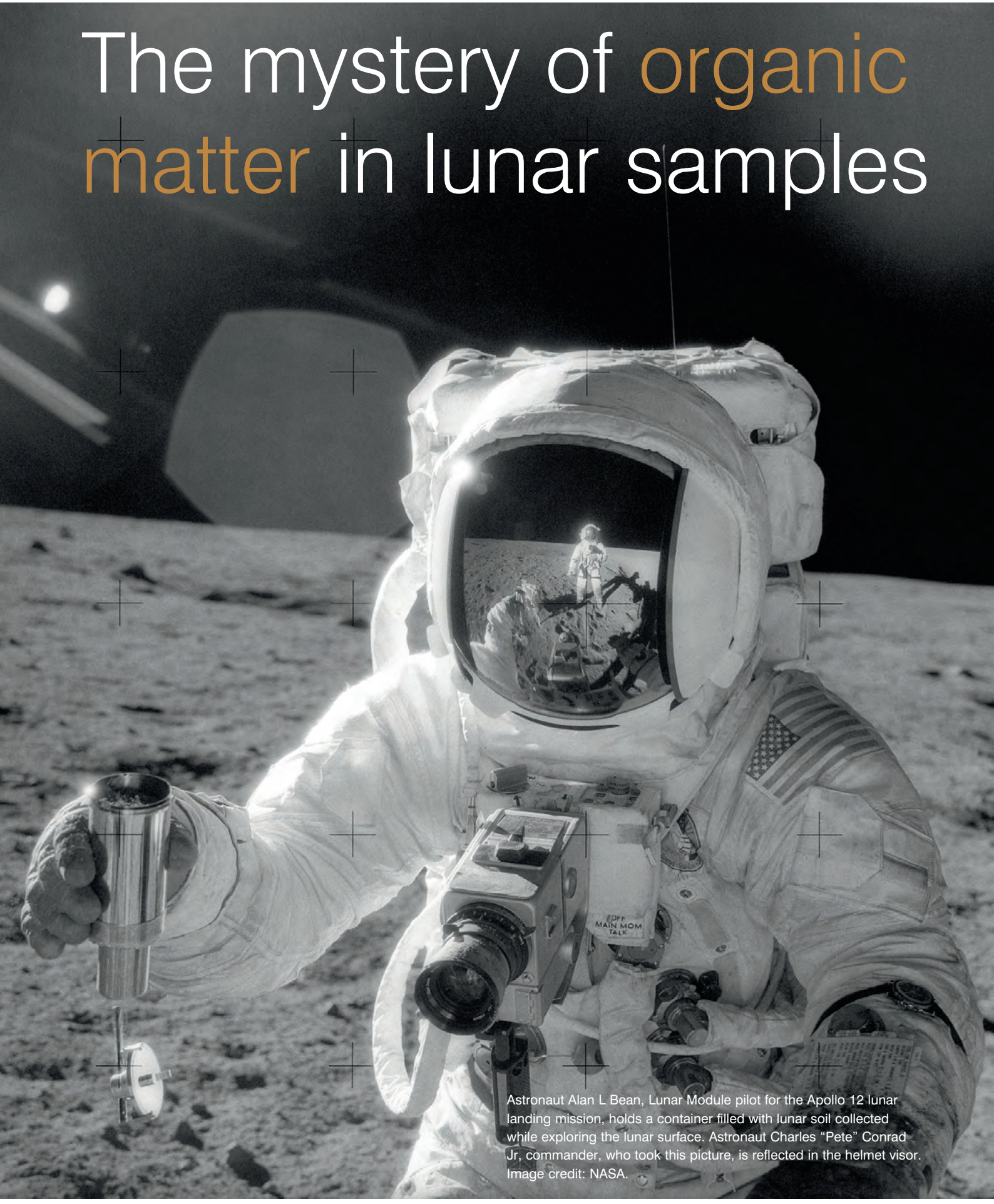
The Thermo Scientific Orion 3106 COD analyser is the latest addition to the portfolio of Orion products serving the wastewater industry. Chemical oxygen demand (COD) analysis is used to detect levels of organic pollutants in water; early identification of these contaminants can indicate an issue in the treatment process of wastewater.

The analyser combines a digestion step with colorimetric analysis to measure the concentration of organic compounds that can affect water quality. Particularly high levels of COD may require additional treatment processes. The presence of high COD levels during the disinfection process will lead to additional hypochlorite dosing. This results in the formation of chloramines, which, if present in high levels, can be carcinogenic.

The analyser is designed to reduce ongoing operating costs due to its low maintenance and reagent consumption. Furthermore, by controlling the treatment process, users can reduce disinfection costs.

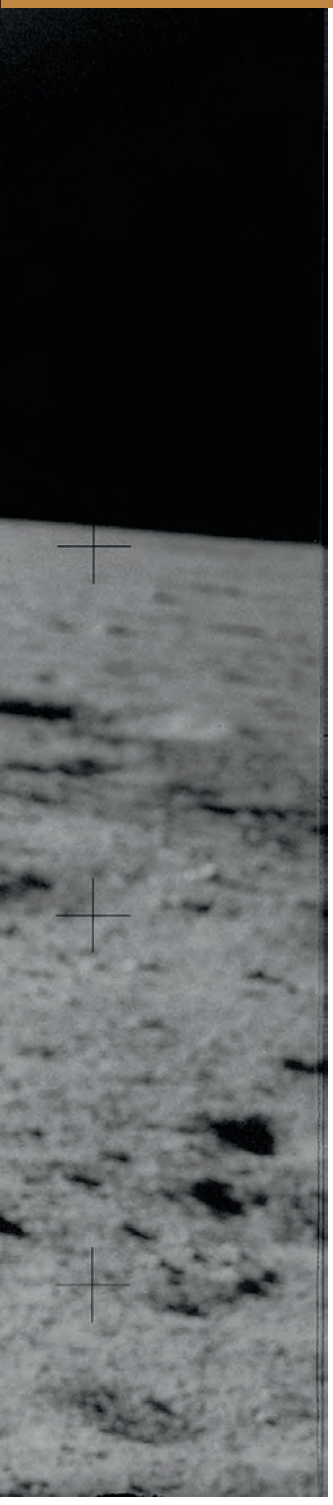
Thermo Fisher Scientific
www.thermofisher.com.au

The mystery of organic matter in lunar samples



Astronaut Alan L Bean, Lunar Module pilot for the Apollo 12 lunar landing mission, holds a container filled with lunar soil collected while exploring the lunar surface. Astronaut Charles "Pete" Conrad Jr, commander, who took this picture, is reflected in the helmet visor. Image credit: NASA.

Scientists have solved a mystery that has plagued NASA since the Apollo missions to the moon — the fact that samples of lunar soil brought back to Earth contained low levels of organic matter in the form of amino acids.



Certain amino acids are the building blocks of proteins — essential molecules used by life to build structures like hair and skin and to regulate chemical reactions. But since the lunar surface is completely inhospitable for known forms of life, scientists don't believe the organic matter came from life on the moon. Instead, they think the amino acids originate from four possible sources:

- Contamination from terrestrial sources (either brought to the moon or introduced while the samples were being handled on Earth);
- Rocket exhaust from the lunar modules which contains precursor molecules used to build amino acids (such as hydrogen cyanide);
- Solar wind, which contains the elements used to make amino acids (such as hydrogen, carbon and nitrogen); and
- Chemical reactions from inside asteroids, fragments of which frequently bombard the lunar surface in the form of meteorites.

"People knew amino acids were in the lunar samples, but they didn't know where they came from," said Jamie Elsila of NASA's Goddard Space Flight Center in Maryland. "The scientists in the 1970s knew the right questions to ask and they tried pretty hard to answer them, but they were limited by the analytical capabilities of the time."

In a study published in the journal *Geochimica et Cosmochimica Acta*, NASA-funded scientists analysed seven samples taken during the Apollo missions and stored in a NASA curation facility since their return to Earth, all of which contained low concentrations (105 to 1910 ppb) of amino acids. At the Goddard Astrobiology Analytical Laboratory, they utilised instrumentation with high enough sensitivity to determine the isotopic composition of an amino acid molecule. This capability enabled the team to say terrestrial contamination was the primary source of the lunar amino acids.

Isotopes are versions of an element; for example, Carbon-13 is a more massive version of the common Carbon-12. Life prefers to use the lighter Carbon-12, which reacts a bit more readily, so amino acid molecules from terrestrial life will have less Carbon-13 compared to amino acids produced by non-biological reactions in asteroids. This is what the team found in one of the lunar samples.

The isotopic composition of the amino acids (glycine, β-alanine and L-alanine) had less Carbon-13 and more closely resembled that from terrestrial sources than that from meteorites. That said, the team also found some amino acids that are extremely rare in terrestrial biology but common in meteorites (eg, Alpha-aminoisobutyric acid). This discovery suggests meteorites may make a small contribution to the amino acids found on the lunar surface, according to Elsila.

Isotopic composition helped rule out solar wind as the source, since solar wind has far less Carbon-13 than what was found in the sample. Also, if solar wind were responsible for the amino acids, then samples taken from near the lunar surface (which had the highest exposure to the solar wind) should have had the greatest abundance of amino acids — but this was not the case.

A similar result on amino acid abundance helped rule out the lunar module exhaust as a source. If contamination from the exhaust produced the amino acids, then a sample taken from right under the Apollo 17 lunar module should have more amino acids than a sample taken far away. However, a sample taken from 6.5 km away had similar amino acid abundances to the one taken beneath the module.

The ability to determine the orientation of an amino acid molecule provided another key clue, according to Elsila. Amino acid molecules can be built in two versions — left and right — that are mirror images of each other, like hands. Terrestrial life uses the left-handed versions, while non-biological chemistry produces the left- and right-handed varieties in equal amounts. In the samples, the team found that the left-handed versions were far more common than right-handed ones for several types of amino acids used to make proteins. This suggests terrestrial life as the source of these amino acids.

The research has important implications for future missions that are looking for extraterrestrial organic matter that may be present, but in very small (trace) amounts. The researchers stated, "This work highlights the fact that even with thoughtful and careful contamination control efforts, trace organics in extraterrestrial samples can be overwhelmed by terrestrial sources.

"Future missions emphasising organic analysis must consider not only contamination control but also include 'witness samples' that record the environment and potential contamination as the mission is built and launched to understand the unavoidable contamination background."

Inline refractometer

Anton Paar has introduced the L-Rix 510 sensor, its first inline process refractometer. The product makes fast, easy work of a wide range of hygienic applications, including measurements on pharmaceuticals, dairy, sugar solutions, syrup, food and beverages containing pulp.

The unit comes ready to install with a preset factory setting that never needs adjustment or recalibration. The sensor's soldered optics need no liquid seals and ensure maintenance-free operation for the first 10 years of its service life. Users benefit from 'fit and forget' simplicity and years of continuous performance.

The product is said to provide refractive index and concentration results comparable to those of laboratory refractometers. Once CIP/SIP routines are completed, the sensor reactivates in just minutes to minimise downtime.

The device brings built-in intelligence to production-line monitoring. An intuitive touch-screen interface makes it easy to set up instrument parameters. It is available in three versions: the L-Rix 510, for use with Anton Paar's mPDS 5 evaluation unit; the L-Rix 510 OT, with a built-in operating terminal that displays measured values; and the L-Rix 510 ROT, which displays values on a remote operating terminal.

The sensor seamlessly integrates with other equipment and controls via analog output or fieldbus connections using PROFIBUS, Modbus TCP and PROFINET, DeviceNet or Ethernet/IP protocols. It conforms with ASME Bioprocessing Equipment Standards and NAMUR NE107 diagnostic standards and is EHEDG certified.

MEP Instruments Pty Limited
www.mep.net.au

Bioinformatics platform

The QIAGEN Clinical Insight (QCI) clinical decision support solution streamlines the annotation, interpretation and reporting of next-generation sequencing results (NGS) for clinical laboratories. The bioinformatics platform has been expanded from interpreting NGS data on somatic mutations in solid tumour cancers to add leukaemia and lymphoma testing, as well as testing for hereditary cancer indications.

The product enables labs to efficiently provide the valuable molecular insights made possible by next-generation sequencing. For somatic cancer indications, the enhancements include insights for diagnostic testing as well as monitoring and progression, support for copy number variations (CNVs) and fusion genes, and additional prognostics data from the literature.

The unit now provides comprehensive cover of FDA- and EMA-approved drug labels, NCCN, ASCO and ESMO professional guidelines, and active genotype-related clinical trials to complement comprehensive coverage of literature references and a wide range of reported case databases. The enhancements also add 32 hereditary cancer genes to QCI's coverage, providing a more complete solution for laboratories to interpret and report on germline variants, including support for NGS comprehensive cancer panels testing for both somatic and inherited cancers.

The product now includes comprehensive curation of the hereditary cancer literature and curated clinical case counts for common heritable cancers including breast and ovarian cancer, Lynch syndrome, Peutz-Jegher syndrome, ataxia telangiectasia, neurofibromatosis, hereditary diffuse gastric cancer, familial prostate cancer, polyposis and more.

QIAGEN Pty Ltd
www.qiagen.com

Test kit for microcystins in water

Microcystest is a test for the detection of microcystins and nodularins (hepatotoxins) in water. The kit is based on the protein phosphatase 2A (PP2A) activity inhibition by microcystins and is therefore able to detect the potential toxicity caused by microcystins in water samples.

Under normal conditions, the phosphatase is able to hydrolyse a specific substrate that can be detected at 405 nm. Samples containing microcystins will inhibit the enzyme activity proportionally to the amount of toxin contained in the sample. The concentration of the toxin in the sample can be calculated using a standard curve.

Microcystest is based on the inhibition of phosphatase activity and therefore able to detect potential toxicity of the sample, offering a great advantage against HPLC or ELISA. Therefore, it is able to detect all microcystins variants. The kit does not need standards of each known or unknown microcystins. The only standard used is Microcystin-LR, and results are calculated as equivalents of Microcystin-LR.

The kit is supplied in two different formats: microtitre plates and tubes. The plate kit is designed for a quantitative assay with a working range between 0.25 and 2.5 mg/L. The tube kit for semi-quantitative or quantitative determinations, with a working range from 0.5 to 2.5 mg/L, does not require a microtitre plate reader — just a normal photometer.

Each kit includes a certificate of analysis, showing the quality controls checks that assure performance.

Novasys Group Pty Ltd
www.novasys.com.au

Controlled lab reactor

The ReactoMate Datum is a compact benchtop controlled lab reactor (CLR) system from Asynt that offers the flexibility to accommodate reaction vessels from 100 mL to 5 L.

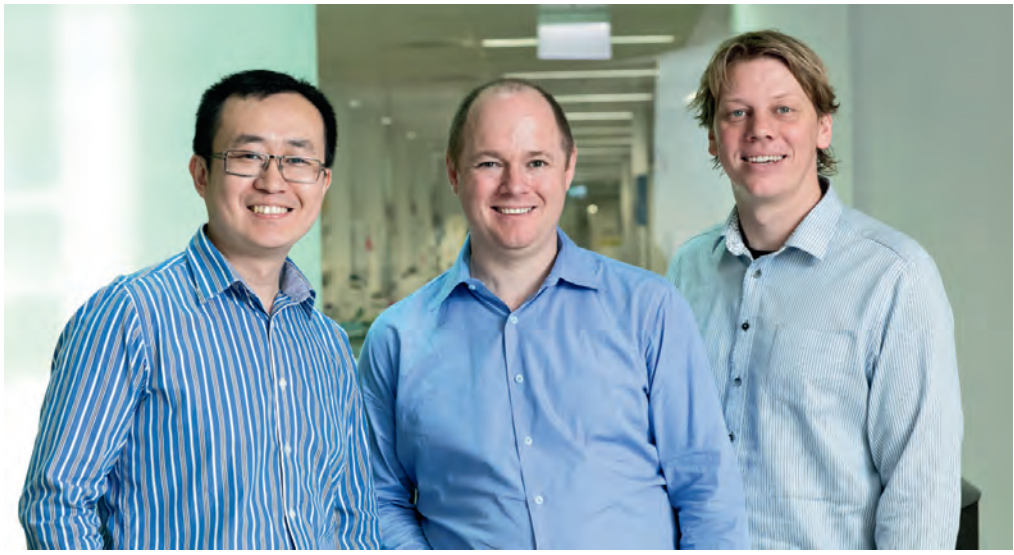
Reaction vessels from Asynt and its partner AG! can be easily exchanged on the lab reactor, allowing chemists to quickly change between reactor vessel sizes and thereby enabling simple synthesis scale-up. A novel mounting mechanism on the stylishly designed device ensures good stability and alignment.

Designed to fit into a standard lab fumehood, the reactor is easy to set up, use and reconfigure. Constructed from anodised aluminium and stainless steel, the CLR system offers users quality, strength and reliability.

The product is fully compatible with leading brands of overhead stirrers and circulator heating/cooling systems. Built to operate over a temperature range from -70 to +220°C, the ReactoMate Datum PT100 temperature probe linked directly to the heating/cooling circulator ensures accurate temperature control. Optional automation packages for the system are available on request from Asynt.

LabFriend
www.labfriend.com.au

Balnaves Foundation funds two more child cancer researchers



L-R: Vincent Jing, Hamish Balnaves and Daniel Carter.

The Balnaves Foundation, a private philanthropic organisation set up by Neil Balnaves AO in 2006, has awarded two Children's Cancer Institute Australia (CCIA) researchers $100,000 each to explore uncharted territory in childhood cancer.

Dr Daniel Carter will be exploiting single-cell profiling technology to seek out effective drug targets in neuroblastoma. Dr Duohui (Vincent) Jing will meanwhile examine the 3D structure of DNA in white blood cells to determine which children with acute lymphoblastic leukaemia (ALL) will respond to standard treatment and which children will not.

Dr Carter will attempt to isolate the descendants of the very first nerve cells to become cancerous in neuroblastoma. The genetic make-up of these original cells will help explain exactly how neuroblastoma develops and how best to tackle it with drugs.

"Prior to single-cell profiling technology, we had to examine the whole organ where neuroblastoma forms, and could only average the genetic profile across hundreds of millions of cells," said Dr Carter.

"Single-cell analysis now allows us to determine the exact genetic makeup of separate cells. The pressing question for me is: what differentiates a cell that may have a kind of precancer characteristic — but is essentially harmless — from one that can actually transition and evolve into an advanced cancer?

"There is one marker that appears to distinguish between the harmless cells and their more lethal counterparts — and that is what I will be examining in this project."

Dr Jing's project will look at the standard protocol for treating patients with leukaemia. Every patient is treated with glucocorticoids for one week and their response determines what the next treatment step will be. Glucocorticoids target glucocorticoid receptors in DNA, which bring about cell death.

Depending on how DNA is folded and compacted into the nuclei of our cells, certain genes will be on the surface, allowing them to be activated. Dr Jing has discovered that patients who respond well to glucocorticoids during the first week of treatment have an open DNA structure at a specific location, while patients resistant to chemotherapy have a closed DNA structure at the same location.

"In my recent study I found one region of DNA that responded to glucocorticoids, and with this Balnaves grant I intend to see how many others I can find," said Dr Jing.

"What I hope to find is a 'gene signature', or cluster of genomic regions with an open configuration, that indicate sensitivity to chemotherapy.

"I will also be looking for differences in the regulatory regions of the genome, because these can produce different outcomes even in patients whose DNA structure looks similar."

The Balnaves Foundation every year offers young researchers the chance to apply for competitively awarded grants of $100,000. General manager Hamish Balnaves hopes the foundation has provided the opportunity for Dr Carter and Dr Jing to progress their work to a stage where it might be published and has a reasonable chance of attracting peer-reviewed funding.

$3 million to fight rare cancers

The Stafford Fox Medical Research Foundation will support the Walter and Eliza Hall Institute (WEHI) in its development of new strategies for diagnosing and treating patients with rare cancers.

Over 42,000 Australians are diagnosed with a rare cancer each year, yet according to Stafford Fox Medical Research Foundation trustee Ken Wallace, few rare cancers have been well researched. "As a result, treatments for many rare cancers have not advanced at the same pace as treatments for common cancers," he said.

With this in mind, the foundation has supplied a $3 million gift to establish the Stafford Fox Rare Cancer Research Program, as well as the appointment of two centenary fellows: the Stafford Fox Centenary Fellow in rare cancer research, awarded to Associate Professor Clare Scott; and the Stafford Fox Centenary Fellow in bioinformatics, awarded to Associate Professor Tony Papenfuss.

The research program will ensure that Australian cancer patients benefit from the latest technologies and research in the hopes of improving their options. According to Wallace, the WEHI team will "use state-of-the-art molecular and genomic technologies to study critical genes that drive rare cancers".

The program will be led by Associate Professor Scott, who is also an oncologist at The Royal Melbourne Hospital. She explained, "A major objective of this research is to recommend effective treatments for rare cancer patients by genetically matching their cancers to existing anticancer medications that are used for more common cancer types.

"Once a treatment for a rare cancer patient is devised, our researchers will monitor the success of the therapy and use this information to guide future treatment recommendations for other patients. It represents a huge step forward in what we could offer patients with rare cancers."

899 new research projects funded

Senator Simon Birmingham, Minister for Education and Training, has confirmed funding for 889 new research projects as part of the Australian Research Council's (ARC) Major Grants announcement.

The ARC Major Grants for 2016 include funding under four ARC schemes. The amounts awarded under each scheme are:

- Discovery Projects — $244.9 million for 635 projects
- Discovery Early Career Researcher Award — $70.7 million for 200 projects
- Discovery Indigenous — $4.1 million for 10 projects
- Linkage, Infrastructure, Equipment and Facilities — $37.9 million for 54 projects

Senator Birmingham said the $357.7 million in funding represents a strong investment in research excellence and the future health of Australian research.

"A strong investment in high-quality research will drive innovation, secure the jobs of the future, improve the health of our community, protect our environment and ensure our researchers can compete on the international stage," he said.

$9 million to treat heart failure and peanut allergies

Victorian medical technology companies Cardiora and Aravax have been awarded $9 million in venture capital funding from the Medical Research Commercialisation Fund (MRCF) to develop novel treatments for heart failure and peanut allergies respectively.

Cardiora will receive up to $4.15 million to pursue development of CRD-102, an oral medicine for the treatment of end-stage heart failure. Early studies indicate the drug is a potential new therapy to ease debilitating symptoms, including shortness of breath, fluid build-up and exercise intolerance. The Australian-developed drug will now be the focus of international clinical trials.

"Early trials of Cardiora's CRD-102 have produced highly encouraging results, with the drug showing great potential as a new agent to improve the quality of life for millions of heart failure patients around the world," said MCRF Investment Manager and Cardiora Director Dr Ingmar Wahlqvist.

$630 million for health and medical research projects

Minister for Health Sussan Ley has announced $630 million to support Australia's researchers in their search to find the next prevention of disease or cure.

The grants were selected by independent panels that drew on the expertise of thousands of researchers to assess applications across 12 different National Health and Medical Research Council (NHMRC) schemes.

The funding will be shared amongst 2200 researchers working on 836 projects. These projects cover areas such as obesity prevention; a new medication to help treat severe ice addiction; new treatment for drug-resistant depression; different treatments for PTSD; and the impact shift working has on pregnancy outcomes.

"The projects span the full spectrum of health and medical research — from commercialising new ideas to improving healthcare delivery, to a basic understanding of diseases at genetic or molecular levels," Ley said.

Ley said the announcement includes $122 million for cancer research, $50 million for mental health research and $25 million for dementia research, amongst other diseases and conditions.

Lauren Davis

Inside the innovation agenda

December 7 last year was a massive day for the Turnbull government, with the Prime Minister announcing his $1.1 billion agenda to promote research, development and innovation. But just what was covered by the National Innovation and Science Agenda (NISA), and how did Australia's scientists react?

Prime Minister Malcolm Turnbull introduced the agenda by highlighting the need to address Australia's falling rankings in terms of commercialisation and collaboration, appetite for risk and participation in high school science, maths and computing. This was followed by the announcement of over 20 initiatives to boost our innovation, with highlights including:

- $106 million in tax incentives for investors looking to support early-stage entrepreneurs
- $75 million to the CSIRO's data research arm, Data61
- $36 million over five years for a Global Innovation Strategy to improve Australia's international innovation and science collaboration
- $30 million for a Cyber Security Growth Centre
- $15 million over four years towards a $200m CSIRO Innovation Fund
- $10 million over four years towards a $250 million Biomedical Translation Fund to develop and commercialise promising outcomes from Australia's research
- $13 million to support gender equity initiatives, including the Australian Academy of Science SAGE program
- $48 million to inspire all Australians on the wonders and uses of STEM in society
- $51 million to better equip students to embrace the digital age
- $1.5 billion locked in for research infrastructure under the National Collaborative Research Infrastructure Strategy (NCRIS), with $520 million set aside for the Australian Synchrotron, for the next 10 years
- The creation of an Innovation and Science Committee of federal cabinet, to be chaired by the Prime Minister

The Australian Research Council (ARC) will assist in measures to boost the commercial returns of publicly funded research, such as the introduction of an impact and engagement assessment of Australian university research. These measures have been welcomed by the council's CEO, Professor Aidan Byrne, who said the assessment will "run alongside Australia's internationally renowned system for measuring research quality — Excellence in Research for Australia (ERA)".


© Sergey Nivens/Dollar Photo Club

> Will this be the start of a new golden age for Australia's innovators? Only time will tell.

According to Professor Byrne, the introduction of the assessment will "ensure there are strong incentives for researchers to produce high-quality and impactful research with real-world benefits". He said the ARC will undertake consultation and development of the assessment in 2016, conduct a pilot assessment in 2017 and hold the first full assessment in 2018.

The agenda has received mostly positive feedback, with the president of Science & Technology Australia (STA), Emeritus Professor Jim Piper, saying, "The government is to be warmly congratulated on a forward-looking agenda that delivers on our calls for a long-term, sustainable plan for science, technology, engineering and maths."

STA CEO Catriona Jackson added her support, noting that the funding not only secures the future of the NCRIS but also places it in the context of "a carefully thought out strategy that spans the whole of government". Jackson also described the creation of an Innovation and Science Committee of federal cabinet as "a very important move" which elevates science and innovation to the very highest levels of government.

Jackson did note that the agenda does not include details of where the funding will come from; these will be released in the coming weeks. She also encourages the government to make ongoing adjustments to the R&D tax concession to ensure it supports the innovation initiatives.

The Australian Academy of Science has welcomed the measures, with secretary for science policy Professor Les Field saying the agenda represents "a turning point". He was particularly favourable towards the Global Innovation Strategy, saying it will "enable Australian scientists and science to be a part of the excellent science and innovation being done around the world", the commitment to improving gender equity in science, and the restoration of funding to the CSIRO and Data61.

The Australian Academy of Technology and Engineering (ATSE) has similarly added its support, with ATSE President (and Australia's next Chief Scientist) Dr Alan Finkel AO saying, "This long-term and thoughtful set of policies that substantially improves the research and innovation ecosystem will be well received."

Dr Finkel said ATSE has previously promoted better research engagement with industry, so the academy is pleased that its efforts have borne fruit. "We congratulate the government for taking a balanced approach in which both research excellence and end-user engagement contribute to the block grant funding formula, providing a balanced pair of metrics in which the new ATSE engagement metric will sit alongside the ERA measure," he said.

The academy noted that a key factor to the success of the agenda, and Australia's long-term prosperity, will be the scale and stability of the measures outlined. The academy equally welcomed the Opposition's commitment to innovation and hopes that all political parties will work together constructively to ensure support for the concept of Australia as an 'innovation nation'.

Finally, the Australian Private Equity and Venture Capital Association (AVCAL) welcomes the agenda for its focus on venture capital investment. AVCAL Chief Executive Yasser El-Ansary said Australia "needs a cohesive policy framework so that high-value, innovative businesses can access funding from a competitive market at every stage"; as such, AVCAL welcomes the government's reforms to the Early Stage Venture Capital Limited Partnership (ESVCLP) framework to unlock greater early-stage investment.

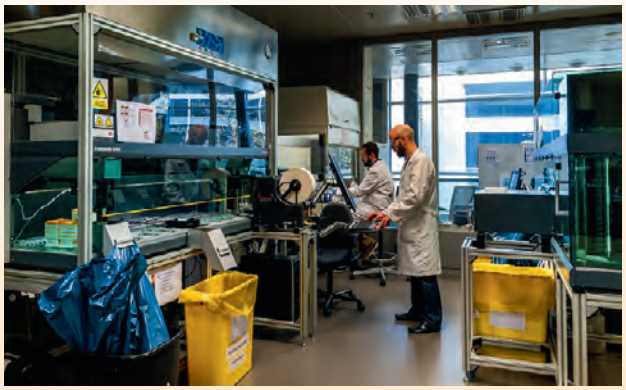
"This, together with other measures such as the new $200 million CSIRO Innovation Fund and $250 million Biomedical Translation Fund, will go a long way towards plugging the current capital and commercialisation gap between our research investment and entrepreneurial potential, with the task of bringing these ideas and products to the market," El-Ansary said.

"However," he added, "better policies to improve STEM education, research and start-up investment need to be supplemented by better policies to improve the availability of later-stage expansion capital as well. The Innovation Statement has not addressed this in any substantial way.

"It should be well understood that it is later-stage capital that directly supports the beginning significant expansion in new jobs, opportunities and sustained growth in a start-up."

Overall, industry has been mostly (and unsurprisingly) united in its praise of an agenda for innovation. In fact, the announcement of NISA follows the Opposition's launch of its own innovation policy, and sees both major parties now committed to many policies in common. Will this be the start of a new golden age for Australia's innovators? Only time will tell.

Tecan helps drive the fuels of the future



At the Madrid-based technology centre of global energy company Repsol, scientists are conducting research into fossil fuel alternatives. Their work relies on the use of two Freedom EVO platforms from Tecan for colony picking and enzymatic assays, as well as the company's 350 µL nested LiHa disposable tips to achieve extended walkaway times.

"The investigation of new biological applications involves screening large numbers of mutants of different microorganisms, enabling the best-performing candidates to be selected for further studies," explained Jose Miguel Seoane, a researcher in the biotechnology department. "As we test thousands of different mutations, automated, high-throughput screening is the key to our success."

Seoane revealed that the researchers generate up to 10,000 colonies per week, meaning long periods of walkaway automation are essential and nested tips are indispensable. "It makes no sense to invest in automation if you need to manually place tips on the workdeck every 20 minutes or so," he noted.

"The release of 350 µL nested LiHa disposable tips, with a novel design incorporating a frame between each tray, was an important development. The trays fit perfectly and the stack remains in perfect alignment, eliminating tip pick-up failures. This makes the workflow more robust and efficient, as well as providing the long walkaway times that we need."

Seoane added that Tecan's field engineers "know the systems well and are very responsive", providing the centre with much-needed support and thus preventing project setbacks. "It is a pleasure to work with the company," he concluded.

Tecan Australia
www.tecan.com.au

Graduated beakers

Kartell manufactures a large range of graduated beakers in a variety of different plastics. They are available with plain-moulded or blue-printed graduations and are suitable for foodstuff.

The PP graduated low-form beaker range conforms to ISO 7056 - 1981 E and BS 5404 Part 1. The beaker is autoclavable to 121°C for 20 min and is suitable for continuous work at 100°C. Manufactured to provide high translucency, the product is available with permanent-moulded graduations or printed blue graduations and also has good chemical resistance.

The PMP TPX graduated low-form beakers conform to ISO 7056 - 1981 E and BS 5404 Part 1. The clear and autoclavable product will withstand temperatures of 170°C for short periods. Manufactured with the option of moulded graduations or printed blue, the product has good chemical resistance.

Both ranges of beakers are available in capacities ranging from 25 to 5000 mL, with sub-divisions ranging from 1 to 500 mL.

Sieper & Co Pty Ltd
www.sieper.com.au

Insulin ELISA kit

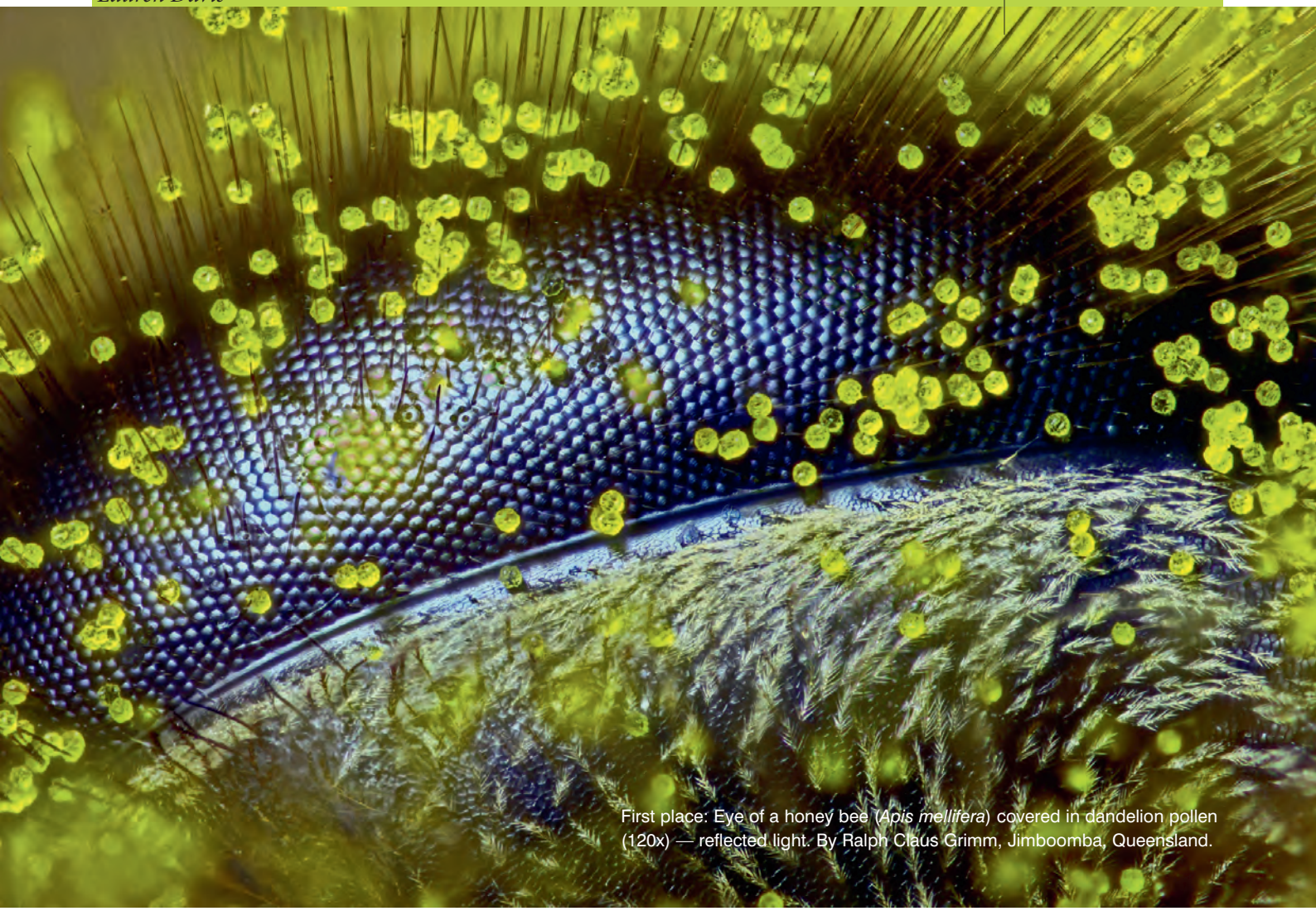
Insulin is a peptide hormone made in the pancreas by beta cells and promotes the uptake of glucose from the blood inside tissues, where it is stored in the form of glycogen and fat. By controlling glucose levels, insulin serves as the central regulator of fat and carbohydrate metabolism.

The Insulin ELISA Kit, from Enzo Life Sciences, enables the detection of insulin in serum, plasma and tissue culture media. Key features include: sensitive measurement of insulin, detecting as little as 21.6 pg/mL; negligible cross reactivity with proinsulin; high-throughput format, with results in 3 h for up to 39 samples in duplicate; and fully quantitative results that are said to surpass semi-quantitative western blot analysis.

The kit is suitable for a variety of research areas, including diabetes mellitus, hypoglycaemia, impaired glucose tolerance, insulinoma, metabolic syndrome and polycystic ovary syndrome.

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

Lauren Davis



First place: Eye of a honey bee (*Apis mellifera*) covered in dandelion pollen (120x) — reflected light. By Ralph Claus Grimm, Jimboomba, Queensland.

Beauty is in the eye of the bee

What's the secret behind taking the winning image in a prestigious photomicrography competition? According to Queensland high school teacher Ralph Grimm, "It takes tons of patience, more than anything else."

Since 1974, the Nikon Small World Photomicrography Competition has recognised the art, skill and scientific value of photography through the microscope. When evaluating the entries in the 2015 competition, the judges found themselves observing everything from chemical compounds to up-close-and-personal looks at biological specimens.

"Each year we are blown away by the incredible quality and quantity of microscopic images submitted from all over the world, from scientists, artists and photomicrographers of all levels and backgrounds," said Eric Flem, communications manager, Nikon Instruments.

"Judges had their work cut out for them in narrowing down from such a rich pool of applicants, and we are so pleased with the results."

Grimm was the lucky winner of this year's top prize — $3000 to put towards the purchase of Nikon equipment — thanks to his stunning close-up of a honey bee eye covered in dandelion pollen grains. The image beat out more than 2000 entries from over 83 countries around the world, which was quite a coup for the self-taught photomicrographer.

"When I received the phone call that I won first place, I felt like I was dreaming," Grimm admitted.

"I am a long-time participant [in the competition] and have entered my work, I think, since 1999.

"I have always admired the first-place winners of previous years, but never believed that I would be one of them."

Grimm was especially aware of the fact that other entrants would have had "state-of-the art fluorescence and confocal technology available to them". Yet the judges found that Grimm's work demonstrated not only artistic quality but also

exceptional scientific technique, with the image having taken over four hours to perfect.

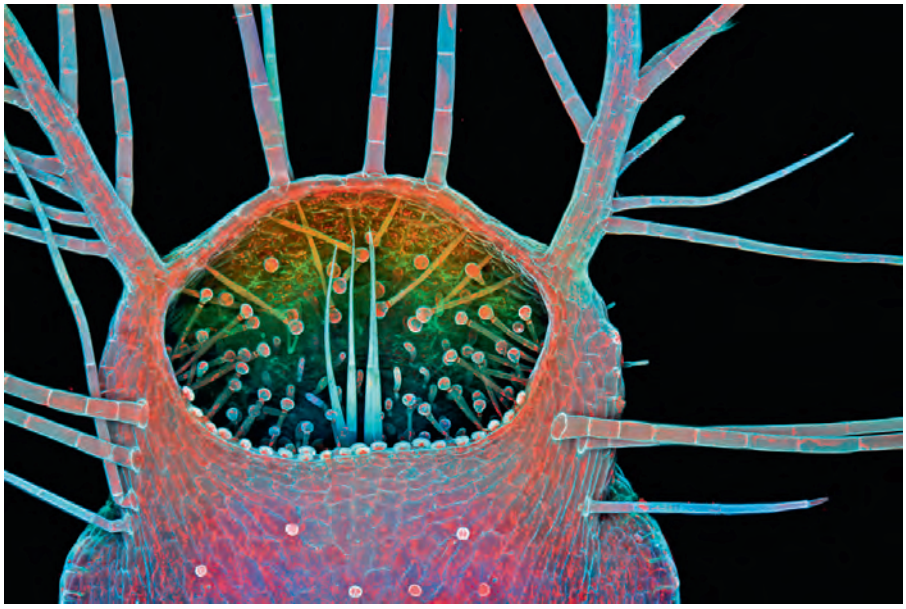
"You may call it a labour of love," Grimm said. "The specimen needs to be fresh, then it has to be secured and mounted on a rotatable base with a pivot so that its angle and position can be changed for composition. After that, the specimen is placed under the microscope.

"Because I'm not using a stereo microscope I have much less depth of field, and working distance is much shorter as well — which makes illumination a bit tricky if you don't have an epi-illuminator. But the most tedious part of this photographic process is actually taking the focus stack, because if not done properly, it will lead to blank areas without any image information. After this is done, the final composite will have to be post processed in Photoshop or Lightroom."

Even after this painstaking process, Grimm admitted that he originally didn't want to submit the image of the honey bee eye at all. But not only had he invested a great deal of time and effort in his creation, it also highlighted an issue which is particularly close to the former beekeeper's heart.

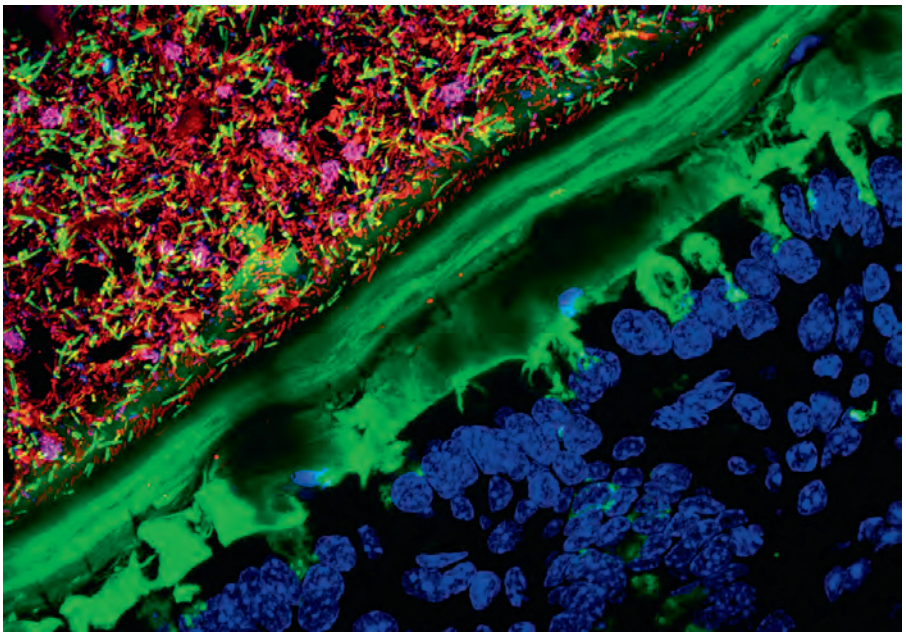
"I wanted to send a message out into the world," said Grimm, "and it came to me that CCD, or colony collapse disorder, represents a serious problem with the honey bee — which is not only of economic concern, but ecological concern as well.

"Anyone can find out about CCD online, but the broader message is that if we don't find a sustainable balance between commerce and the ecology, in the end nature will win. If the honey bee dies out, our lives will no longer be worth living. Food diversity will be severely reduced, and because 70% of crops need bee pollination, the agricultural industry will experience mega losses.



Third place: Intake of a humped bladderwort (*Utricularia gibba*), a freshwater carnivorous plant (100x) — confocal. By Dr Igor Siwanowicz, Howard Hughes Medical Institute, Maryland, USA.

"A lot of factors seem to play together in the decline of honey bee populations — such as new types of pesticides, increasing parasite infestation and lack of genetic diversity — but I am particularly worried about the way humans rapidly change the environment. There is a lot of ignorance about this situation, especially here in Australia, with the building and construction madness shamelessly making room for city expansion and population growth. It's my little way of expressing my fear. The bee, to me, is like a sweet prophet with a sour message."



Second place: Mouse colon colonised with human microbiota (63x) — confocal. By Kristen Earle, Gabriel Billings, KC Huang and Justin Sonnenburg, Stanford University School of Medicine, California, USA.

Of course, Grimm was not the only photomicrographer highlighted in the competition. Coming in second place was the joint effort of Kristen Earle, Gabriel Billings, KC Huang and Justin Sonnenburg from the Stanford University School of Medicine, USA. Their image displays the colon of a mouse that was born germ-free. The mouse was colonised with a human microbiota and used DNA probes to label certain taxa — in this case, members of the *Bacteroidetes* and *Firmicutes phyla*.

In third place was Dr Igor Siwanowicz from the Howard Hughes Medical Institute (HHMI), USA. His image shows the entrance to the trap (or bladder) of the humped bladderwort (*Urticulatia gibba*), a carnivorous freshwater plant. Several elements of the bladder's construction are visible in the image, giving some insight into the workings of this elaborate, 1.5 mm-long suction trap.

All the winners of this year's competition — including the Top 20, 12 Honourable Mentions and 56 Images of Distinction — can be found at www.nikonsmallworld.com/galleries/photo. Grimm hopes the images will be of interest to the general public as well as scientists, saying, "The beauty of nature captured by a photographer should evoke a sense of awe in viewers without a scientific background."

"Nikon is doing a wonderful job by giving the work of photomicrographers around the world a chance to be noticed by a larger audience," said Grimm.

Carbon dating
a kidney stone

A scientist at the Australian Nuclear Science and Technology Organisation (ANSTO) has been involved in an experiment said to be the first of its kind — carbon dating a kidney stone.

It all started when Vladimir Levchenko found out he was one of the 10% of Australian men who are affected by kidney stones. Kidney stones are a common disorder, yet very little is known about their growth cycle and longevity. Furthermore, said Levchenko, "almost no-one in Australia was undertaking research in this area".

As an expert in accelerator mass spectrometry (AMS), Levchenko decided to apply carbon-dating procedures to kidney stone samples — ie, measuring how much carbon-14 is present — to see if he could ascertain their age. He obtained the most common kind of stone — a calcium oxalate kidney stone, which contains carbon and therefore enables the use of AMS to measure the amount of carbon-14. It is believed that this is the first time radiocarbon has been used to date a kidney stone.

The first step was to sample the calcium oxalate by progressively dissolving it to extract the carbon. Later, the oxalate was combusted to CO_2 and this gas converted to graphite for isotopic carbon determinations. Measurements on the 2MV Star accelerator, located ANSTO's Centre for Accelerator Science, indicated that the stone had been growing steadily for 17.6 years.

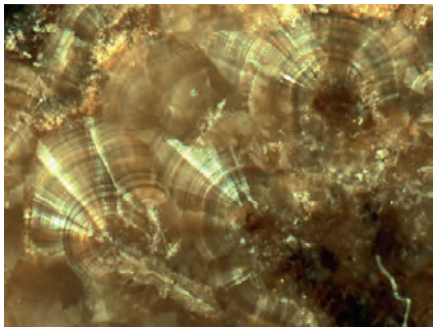
Following his initial discoveries, Levchenko began collaborating with a Dutch research group led by Dr Dirk Kok, head of the Department of Urology at Erasmus University Medical Center, Rotterdam. Levchenko explained, "Dr Kok wanted to send over two similar samples that his team were investigating, in order to find out if they were the same age and if both contained phosphate."

Once the stones had been sent to ANSTO's Lucas Heights facility from the Netherlands, Levchenko provided high-resolution CT scans of the stones that depicted their interior, which showed they were not uniform and contained voids. Measurements found that the two samples were vastly different ages — 23 and seven years old, respectively — with only one containing phosphate. As the stones were of similar size, it suggested that one grew faster than the other.

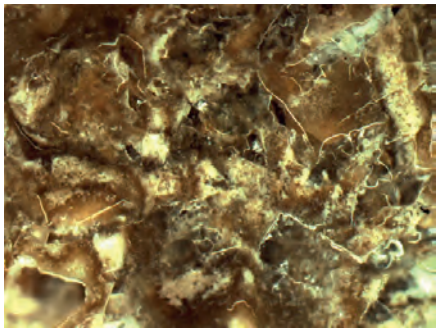
"Information from the original 'owners' of the stones identified that the stone containing phosphate came from a person who regularly consumed soft drink — which contains phosphoric acid," Levchenko noted. He added that once the age of one of the stones was determined, it was linked to a trauma that the patient had received when younger.

"This connection could not have been made without dating the stone," said Levchenko.

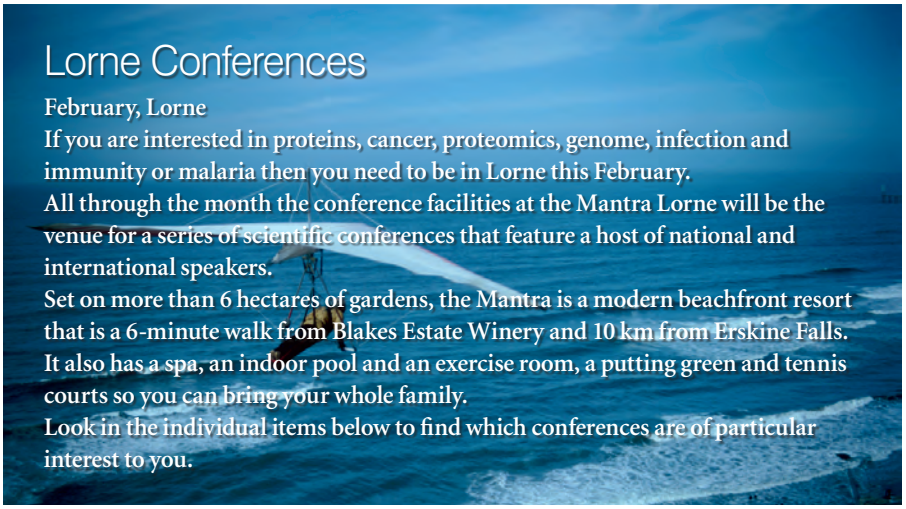
According to Levchenko, scientists have previously not been able to make "anything near the kind of connections the radiocarbon dating has allowed". His research was received with great interest at the 12th Meeting of European Association of Urology and has been accepted by the journal *Radiocarbon*.



Microphotograph of interior structure of 23-year-old kidney stone made of calcium oxalate. Structured pattern with growth layers visible. (50x magnification.)



Microphotograph of interior structure of six-year-old kidney stone made of calcium phosphate. Unstructured aggregate of crystal and organic material. (50x magnification.)



Lorne Conferences

February, Lorne

If you are interested in proteins, cancer, proteomics, genome, infection and immunity or malaria then you need to be in Lorne this February.

All through the month the conference facilities at the Mantra Lorne will be the venue for a series of scientific conferences that feature a host of national and international speakers.

Set on more than 6 hectares of gardens, the Mantra is a modern beachfront resort that is a 6-minute walk from Blakes Estate Winery and 10 km from Erskine Falls. It also has a spa, an indoor pool and an exercise room, a putting green and tennis courts so you can bring your whole family.

Look in the individual items below to find which conferences are of particular interest to you.

24th Australian Conference on Microscopy and Microanalysis
January 31–February 4, Melbourne
www.acmm24.org

Proteomics
February 4–7, Lorne
www.australasianproteomics.org

Proteins
February 7–11, Lorne
www.lorneproteins.org

Cancer
February 11–13, Lorne
www.lornecancer.org

Genome
February 14–17, Lorne
www.lornegenome.org

Infection and Immunity
February 17–19, Lorne
www.lorneinfectionimmunity.org

Molecular Approaches to Malaria
February 21–25, Lorne
www.mamconferences.org

ANZMET
March 29–31, Melbourne
www.anzmet.org

ESA Seminar
May 13–15, Sunshine Coast
www.esaseminar.org.au

ANR
June 19–24, Cairns
www.anr2016.org

ANZCHOG Satellite
June 23–25, Cairns
www.anr2016.org/anzchog

ASM
July 3–6, Perth
www.asm2016.asnevents.com.au

SMBE
July 3–7, Gold Coast
www.smbe2016.org

IVIS
August 17–20, Gold Coast
www.ivis2016.org

Reproductive Immunology
August 17–20, Cairns
www.reproductiveimmunology2016.org

ESA Clinical Weekend
August 19–21, Gold Coast,
www.esaclinicalweekend.org.au

ESA-SRB-ANZBMS
August 21–24, Gold Coast
www.esa-srb.org.au

ENSA
August 22, Gold Coast
www.ensa.org.au

ADS-ADEA Roche Educators Day
August 23, Gold Coast
www.ads-adea.org.au

ADS-ADEA
August 24–26, Gold Coast
www.ads-adea.org.au

ASFB
September 5–8, Hobart
www.asfb.org.au

AGITG
September 13–16, Melbourne
www.agitg.org.au

ANZOS
October 15–17, Brisbane
www.anzos.com

ASMR NSC
November 13–16, Gold Coast
www.asmr-nsc.org.au

COSA-ANZBCTG
November 14–17, Gold Coast
www.cosa.org.au/groups/breast-cancer/resources.aspx

APHIA
November 15–19, Perth
www.aphia.org.au

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- ☐ Food - Fruit & Vegetables
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- ☐ Laboratory - Clinical/Medical
- ☐ Laboratory - Life Sciences
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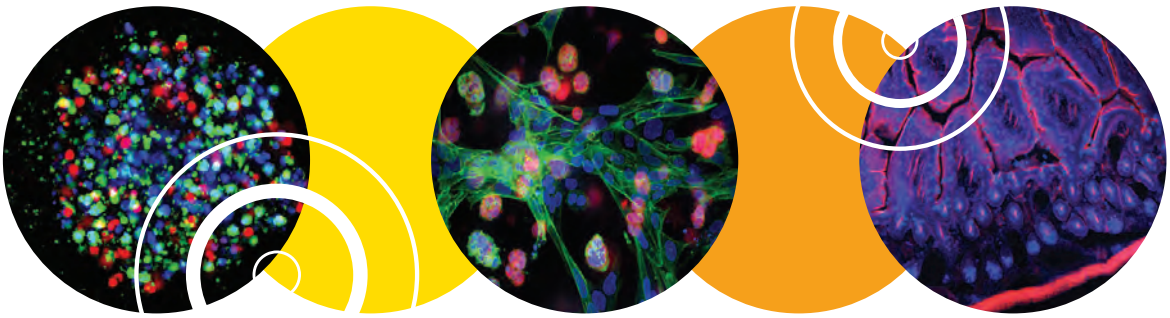
- ☐ Over 500

L+LS

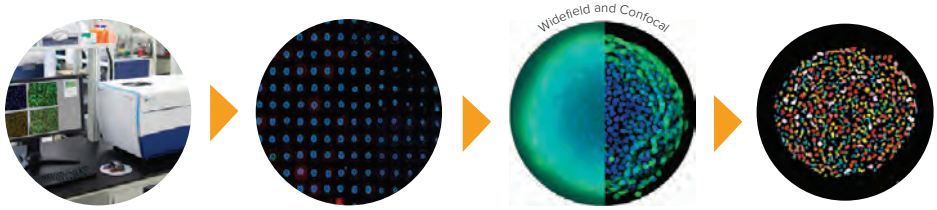


NEW ImageXpress Micro Confocal High-Content Imaging System

Explore a new dimension with confocal technology - at the speed of widefield

MOLECULAR DEVICES

- Match acquisition mode to your assay needs with multiple confocal geometries and widefield mode
- Capture publication-quality images without sacrificing throughput using proprietary AgileOptix™ technology
- Acquire statistically relevant data faster with large field of view and >3 log dynamic range
- Expand your research capabilities with transmitted light, liquid handling, and environmental control options



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delivering technology

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SHIMADZU
Excellence in Science

Changing the way you think about Science

Special Life Science Edition

Nexera X2
Ultra High Performance Liquid Chromatograph

Maximizing the Potential of UHPLC/HPLC Analysis

Meet the Nexera X2, the most advanced UHPLC available today. The flexible system design achieves a true fusion between UHPLC and HPLC technologies, enabling the Nexera X2 to be used for a much broader range of applications. This completely new UHPLC system not only offers maximum speed, sensitivity, resolution, stability, and reliability, it also features a revolutionary i-PDeA separation technology and an i-DReC function that extends the dynamic range so that both concentrated and trace components can be quantitated simultaneously.

Intelligence Intelligent data solutions, including a new i-PDeA peak calculation method for enhanced separation power, accelerate workflows.

Sensitivity The ultimate platform for high-sensitivity UHPLC and HPLC detection.

Resolution Enhanced peak resolution achieved by minimizing external column dispersion.

Stability Superior stability for UHPLC/HPLC analyses.

i-Series Nexera-i Prominence-i

Integrated Liquid Chromatography

Ideal Instrument for Teaching Laboratories

- Minimal bench space required and cost effective
- Remote monitoring regardless of operating environment
- Maximum reliability and stability
- Dual temp-control with TC-Optics and flow cells unaffected by room temperature fluctuation
- Excellent micro injection volume reproducibility of 1 µL or less
- Ultrafast injection cycle reduces analysis times

Achieving Easier Operation

- Unified graphical user interface between system and workstation
- Create analytical sequences on visualized vial positions: Quick batch function

Smart Features Increase Work Efficiency

- Automation of a number of routine analysis procedures
- Migrate existing methods from either Shimadzu or non-Shimadzu systems

UF-Amino Station

LC/MS Ultra Fast Amino Acid Analysis System

Analyze 38 amino acid components in just nine minutes!

Using an LC/MS instrument provides accurate analytical results even with difficult samples containing many impurities.

Fully automated derivatization using the Sil-30AC autosampler to automatically pretreat the sample, eliminates the need for manual sample preparation.

LCMS-8060

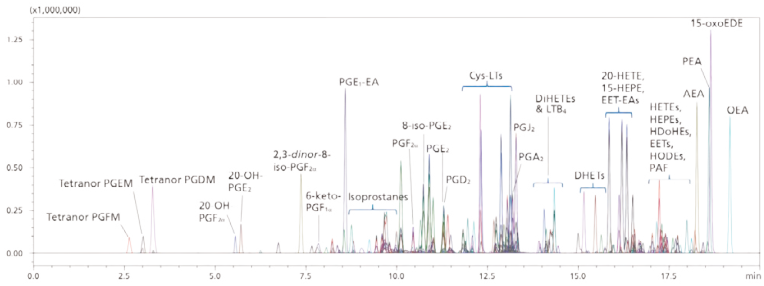
Triple Quadrupole Mass Spectrometer System

The LCMS-8060 is the ideal instrument for peptide biomarker validation.

Coupling UHPLC to high sensitivity/fast triple quad systems is more reproducible, faster and easier to use than nano mass spectrometry for quantitative analysis.

Standard flow UHPLC is ideal for biomarker pre-clinical validation due to its sensitivity speed and robustness. Short dwell times and scheduled MRM's allow for several thousand peptides to be quantified in one short run.

MRM Chromatogram for 158 Lipid Mediators and Related Compounds



LC/MS/MS Method Package for Lipid Mediators

Ready-to-Use Analytical Conditions and MRM Transitions

Lipid mediators (bioactive lipids) have important physiologicalfunctions and have been associated with lifestyle-related diseases like diabetes and allergy diseases.

This method package provides a simultaneous analysis method that encompasses 158 compounds of lipid mediators derived from arachidonic cascade and its derivatives.

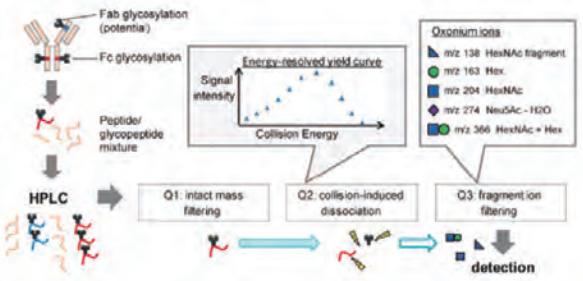
UFMS Technology Covers Wide Range of Compounds

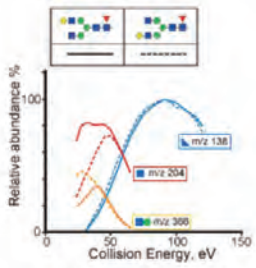
ESI negative ionization is commonly used for the measurement of fatty acids but in the case of important lipid mediators such as anandamide, ESI positive ionization is preferred because higher sensitivity is achieved. Traditional LC/MS is limited to single-polarity analysis, but Shimadzu's UFMS technology allows the LCMS-8050 to perform 5 msec high-speed polarity switching, enabling multiple classes of analytes to be analysed in a single run without loss of data quality.

Erexim Application Suite

Software Platform for Glycan Quantification and Qualification by LCMS-8060/8050

When analyzing glycans or glycan-containing molecules by MS/MS, the product ions generated by fragmentation include a high abundance of glycan-derived low m/z ions called the oxonium ions. Although the species and relative abundance of oxonium ions reflect the glycan structure of origin, conventional MS/MS provides insufficient features to differentiate between glycan structures. Energy-resolved oxonium ion monitoring, abbreviated as Erexim, adds another dimension to MS/MS data by acquiring data at a series of collision energies (CE) of fragmentation. A plot of the change inoxonium ion abundances with respect to CE, the Erexim profile, now contains the resolving power to differentiate between similar glycan structures. Erexim requires triple quadrupole mass spectrometry for its ultrafast scan speed to acquire a multitude of data points and for its quantitative ability to acquire reproducible profiles. Moreover, one of the product ions targeted in Erexim is specific to the N-glycan core structure and is an ideal reporter ion for relative quantitation of glycan structures.





Reference:
A. Toyama et al., Anal. Chem. 2012, 84, 9655-9662

Shimadzu now works with Skyline

Shimadzu 8060 is fully compatible with MacCoss Skyline proteomics software, allowing the seamless integration of any Shimadzu triple quadrupole mass spectrometer into your current mass spec proteomics facility. Skyline can help rationalise and optimise your peptide selection through to label free quantitation.

Prominence GPC System

Prominence Gel Permeation Chromatography System

The Prominence GPC System provides highly reliable and highly extensible performance in a wide variety of applications. Hardware that provides rapid instrument stabilization and excellent reproducibility of analytical results, and software that includes analytical workflow automation and overlap injection functions and features a user-friendly analysis screen view contribute to improving productivity.

Shimadzu has worked hard on every individual element influencing the basic performance of the Prominence GPC System to provide highly reliable analytical results for all customers.

Wyatt Technology CORPORATION

Wyatt Technology Corporation is the world's leading supplier of multi-angle static light scattering – and other instruments for absolute macromolecular characterization.

Dynamic Light Scattering (DLS)

Dynapro™ NanoStar

Stand alone Dynamic Light Scattering instrument for measuring the sizes of proteins, nanoparticles, vesicles, and more!

Dynapro™ Plate Reader

Automated high throughput dynamic light scattering technology to measure the sizes of proteins and nanoparticles in 96/384/1536 well plates.

WyattQELS™

Quasi-elastic light scattering (QELS) which interfaces to the MALS instruments for on-line size measurements of proteins and nanoparticles.

Field Flow Fractionation

Eclipse™ AFFF

Asymmetric-Flow Field-Flow Fractionation connects to MALS systems to separate and characterise proteins, nanoparticles and polymers. The Eclipse® DUALTEC is the first FFF system using Hollow-Fiber Flow-FFF (HF5) and Asymmetric Flow-FFF (AF4) techniques integrated into one instrument.

Viscometry

ViscoStar™ II Viscometer

On-line differential viscometer with unparalleled signal-to-noise ratio, low baseline drift and noise. Measures the intrinsic viscosity and Mark Houwink-Sakurada (MHS) parameters of polymers. Ethernet and USB connection, transducer protection system and selectable delay volumes.

Electrophoretic Mobility

Möbius

Möbius measures the electrophoretic mobility and zeta-potential of not only large particles, but samples down to 1nm. Designed specifically to address the measurement of protein mobilities, Möbius achieves reproducible measurement of traditionally very challenging samples such as antibody formulations, bovine serum albumin and lysozyme.

PPSQ-51A / 53A

Protein Sequencer

Greater Simplicity and Reliability in the Determination of Amino Acid Sequences Software Compliant with FDA 21 CFR Part 11

Analytical Stability and Higher Detection

- Baseline stability
- Retention time reproducibility
- Higher detection

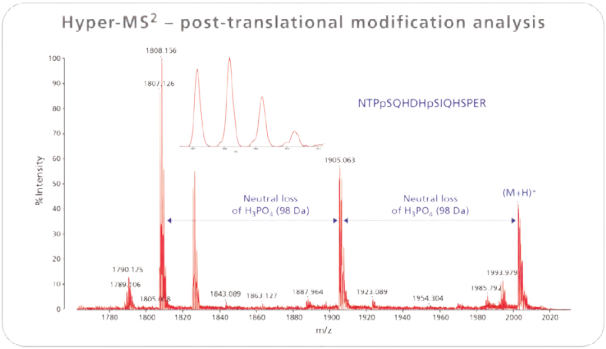
Compliance with FDA 21CFR Part 11

- Security
- User management
- Audit trail
- Software validation

MALDI-7090™

Mass Spectrometer

The MALDI-7090TM is targeted for proteomics and tissue imaging. It combines Shimadzu's extensive MALDI TOF-TOF mass spectrometry expertise with novel patented technology to provide ultimate performance in identification and structural charactersation of biomolecules.



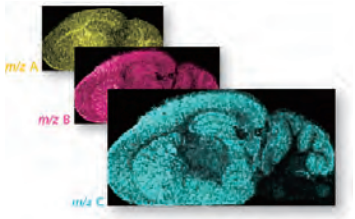
MALDI-7090 sets a new benchmark in MALDI TOF-TOF design:

- Market leading MS/MS resolution
- Proprietary solid state UV laser technology
- Ultra Fast acquisition speed in MS and MS/MS
- Integrated 10 plate loader
- Newly designed MALDI Solutions™ software
- Unique UV laser source cleaning

iMScope *TRIO*

IMAGING MASS MICROSCOPE

OPTICAL MICROCROSCOPE
Capture an optical microcroscope image



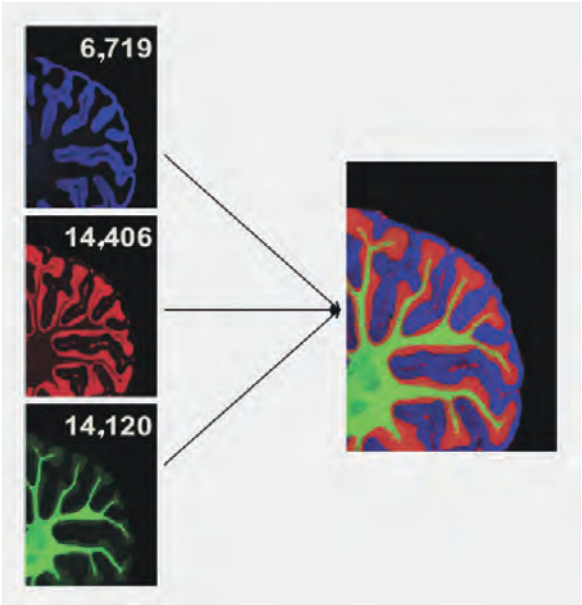
MULTIPLEXED IMAGING
Generate molecular distribution images (multiplexed imaging) based on single ms intensity specifications.

Imaging mass spectrometry is a revolutionary new technology.

The instrument is a combination of an optical microscope which allows the observation of high-resolution morphological images, with a mass spectrometer which identifies and visualizes the distribution of specific molecules.

Superimposing the two images obtained based on these very different principles, has created a significant new research tool, the imaging mass microscope.

The accurate and high resolution mass images from the iMScope TRIO will drive your research to the next level. At long last, we have entered the age of imaging mass spectrometry.



HTXImaging
by HTX Technologies, LLC

The HTX TM-Sprayer™ System

The HTX TM-Sprayer™ System is an automated MALDI matrix deposition system offering high reproducibility and superior data quality for Mass Spectrometry Imaging

In this experiment, 10µm thick rat cerebellum tissues section were mounted on ITO coated glass slides, allowed to dry 30 min in a dessicator and then washed in ethanol to remove disturbing lipids and salts.

The sections were then air dried before applying matrix with the TM-Sprayer.

UFMS
ULTRA FAST MASS SPECTROMETRY

GCMS-TQ8040

Gas Chromatograph Triple Quadrupole Mass Spectrometer

The Shimadzu GCMS-TQ8040 is the first triple quadrupole with Smart Productivity for high efficiency sample throughput, Smart Operation for quick and easy method development, and Smart Performance for low detection limits and Scan/MRM.

Smart Productivity

This new firmware protocol enables MRM analysis with up to 32,768 transitions in a single analysis, dramatically increasing productivity.

Smart Operation

With Smart MRM, the GCMS-TQ8040 software sets the analytical conditions automatically, making method development painless, fast, and easy.

Smart Performance

The exceptionally efficient ion source and collision cell provide low detection limits. High speed scanning control and simultaneous Scan/MRM analysis mode provides high quality library searchable fragmentation spectra, and accurate low-level quantitative data in a single analysis.

GCMS-QP2020

Gas Chromatography Single Quadrupole Mass Spectrometer

The importance of high-performance analytical instruments for monitoring microscopic quantities of compounds related to environmental pollution and human health, and for developing and evaluating new, highly functional materials and chemical products continues to grow.

The GCMS-QP2020 has been designed to meet these needs. Featuring enhanced instrument functionality, analysis software, databases, and a sample introduction system, the GCMS-QP2020 will help maximize the capabilities of your laboratory.

CONSUMABLES

Gas Traps

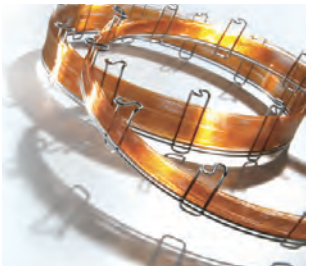
Shimadzu offers a comprehensive range of stand-alone and quick-fit gas trap systems for GC, GCMS and LCMS gas management requirements.

- Full range of gas regulators and accessories
- Fittings, tubing, valves and a wide variety of tools for gas fittings and gas management.

RESTEK Sky® Inlet Liners

The most inert liners on the market today. This is due to a state-of-the art deactivation process that completely passivates the liner and wool.

- They are inert to a wide variety of reactive analytes including active acidic and basic compounds.
- They are demonstrably the best liners available for trace analysis.



GC Capillary Columns

Inertness is one of the most difficult attributes to achieve in column manufacturing, but it is also one of the most critical as it affects detection through both peak shape and retention time stability. Rxi® technology produces the most inert columns available.

RF-6000

Spectrofluorophotometer

Wide Variety of Spectral Techniques

- Enhanced sensitivity and dynamic range enable fluorescence as well as bioluminescence, chemiluminescence, and electro-luminescence measurements.
- High-speed 3D scanning enables rapid acquisition of 3D spectra.
- Spectrum-Corrected Excitation and Emission spectra can be scanned.
- Fluorescence quantum yield and Fluorescence quantum efficiency measurements are available.

IRAffinity

FTIR

The IRAffinity has the highest S/N ratio in its class.

- 0.5 cm-1 resolution and compact dimensions.
- S/N ratio of 30,000:1 using a high-energy ceramic light source, and temperature-controlled high sensitivity DLATGS detector.
- Ease of maintenance as the interferometer is airtight and incorporates an internal desiccator.

UV-1800

UV-VIS Spectrophotometer

Exceeding Pharmacopoeia regulations, the UV-1800 offers an array of user-friendly features. It may be configured standalone or PC-controlled. Featuring the highest resolution in its class (1 nm), it easily satisfies required wavelength resolution.

- Czerny-Turner optical layout results in a compact, high-throughput optical system with low stray light, wavelength repeatability and baseline stability.

UV-1280

UV-VIS Spectrophotometer

Designed by the leaders in UV-Visible Spectroscopy for molecular absorption quantitative analysis, the UV-1280 Multipurpose UV-Visible Spectrophotometer offers wavelength scanning from 190-1100nm. This lower-cost, high-quality instrument is ideal for applications ranging from routine environmental and food quality testing to life science analyses.

CONSUMABLES

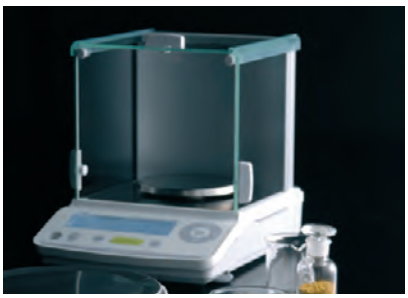
Spectro/Cuvettes

Shimadzu is pleased to release a new range of spectrophotometry consumables. We offer cells made from the finest quality Special Optical Glass and Synthetic Quartz.

- Cuvettes for samples in a variety of sizes and optical materials.
- Cleaning and handling products for cells and optical parts.
- NIST-traceable Calibration Filters and kits for both VIS and UV work.
- On-site Performance Verification Certification Service by Shimadzu engineers.

UniBloc Balances

This patented technology which is now called "UniBloc" is the superior mechanism underpinning most Shimadzu balances. Each Shimadzu balance also comes with Windows® Direct functionality, so no additional software is needed to interface with spreadsheets, databases, word processing and laboratory software.



Top Loading Balances

Shimadzu top-loading balances also with UniBloc have unrivalled quick response, stability and durability at the same time. The UW Series and new lower cost TW Series (pictured) come with motor-driven built-in calibration weights and fully-automatic calibration functions.

MOC63u Moisture Balance

The MOC63u Moisture Balance incorporates a UniBloc Aluminum Alloy Mass Sensor, replacing the conventional electromagnetic balance sensor assembly. The UniBloc's compact, uniform structure ensures stable temperature characteristics, excellent response time and table corner-load performance.

Dual-range Semi-micro Balances

AUW-D dual-range semi-micro balances are the world's first 5-decimal place balances with one-piece force cell technology providing excellent response, stability and zero return performance, The popular AUW220D has 220g/0.0001g 82g/0.00001g capacity and minimum display.

AP Series - COMING SOON!

Advanced Performance UniBloc Balances

Faster Response and Higher Stability with a New Stage of Analytical Balances

- **High Speed**
  Fast weighing response
- **Stress Free**
  Reliable weighing results
- **Save Your Operations**
  Various function for weighing

50% OFF SELECTED USED AND EX-DEMO INSTRUMENTS*

20% OFF ALL CONSUMABLES*

* Offers expire 31 March 2016

CHROMATOGRAPHY
SPECTROSCOPY
BALANCES
ANALYSERS
LIFE SCIENCE
MATERIALS TESTING

SHIMADZU

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