Lab+Life SCIENTIST

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COMBATING SEAFOOD FRAUD

DRUG ATTACKS DORMANT HIV CELLS

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I'll have the catch of the day

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With the weather warming up and summer lurking just around the corner, many Australians will be looking to fill their plates with their favourite seafood dishes. Of course we all know that omega-3 fatty acids — which are abundant in fish and fish oil supplements as well as nuts, seeds and plant oils — are good for our hearts and our brains, but did you know they are also good for our lungs?

US researchers recently pointed to a longitudinal study showing that higher levels of omega-3 fatty acids (particularly docosahexaenoic acid, or DHA) in a person's blood were associated with a reduced rate of lung function decline, while genetic data from over 500,000 UK Biobank participants showed that higher levels of fatty acids including DHA were associated with better lung function. This research is understood to provide some of the strongest evidence to date of this association, underscoring the importance of including omega-3 fatty acids in the diet.

A Swedish study has meanwhile found that preterm babies given a supplement with a combination of omega-3 and omega-6 fatty acids go on to have better visual function. The study of 178 extremely preterm babies saw around half the participants given preventive oral nutritional supplements containing DHA, as well as the omega-6 fatty acid AA (arachidonic acid). Researchers had previously found that the combination supplement led to the risk of contracting the sight-threatening eye disease ROP (retinopathy of prematurity) being halved, but the new study showed that those who received the supplement had improved visual function at two and a half years of age regardless of whether or not they had previously had ROP. This improved visual development was not only due to the beneficial effect on the retina — the supplement also seemed to improve the brain's ability to interpret visual impressions.

It seems clear, then, that omega-3 fatty acids found in fish are good for us — but how do we know that the fish we're purchasing is the fish we're receiving? On page 14 of this issue, we outline how the US National Institute of Standards and Technology (NIST) is fighting food fraud with the development of new salmon and shrimp reference materials, which can help to verify where seafood was caught or produced. We also have a couple of other articles on the topic of food science — turn to page 32 to follow Dr Woojeong Kim's research into the potential of plant-based proteins, or to page 23 to learn about the bioreactor enabling one ambitious company to create cultivated meat.

Elsewhere in this issue, we look at recent efforts to improve data handling and data integrity in the lab, which will always be an issue no matter what branch of science you specialise in. Flick to page 20 for an insight into how AI image proofing software can make it easier to perform the image analysis required before study publication, or to page 26 to see how graph technology can help life sciences users to analyse large, complex datasets. That's in addition to our regular news, product releases and other articles, all of which are just waiting to be read — so why not get started now? I swear you'll be hooked!

Regards,
Lauren Davis
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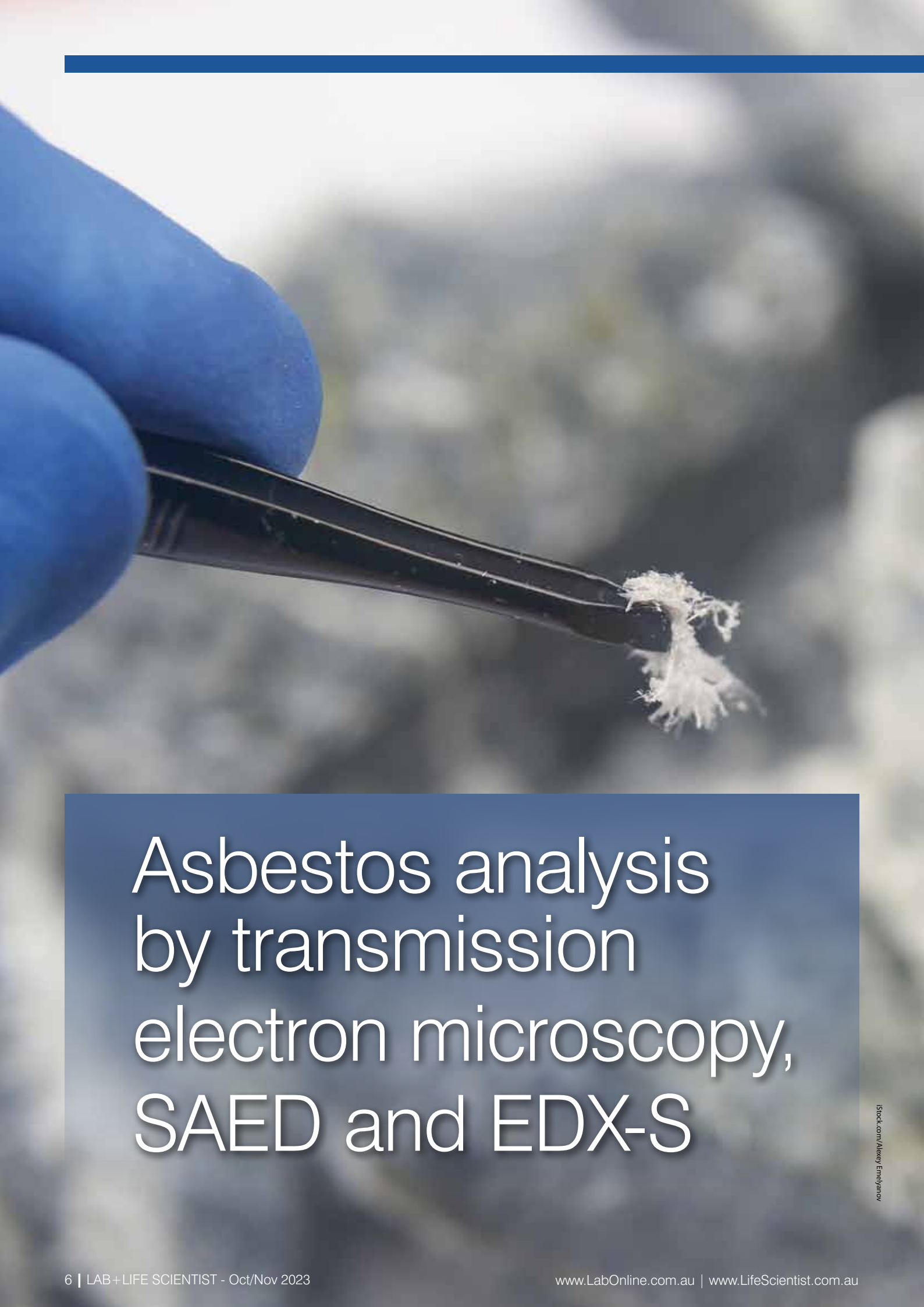

Asbestos analysis by transmission electron microscopy, SAED and EDX-S

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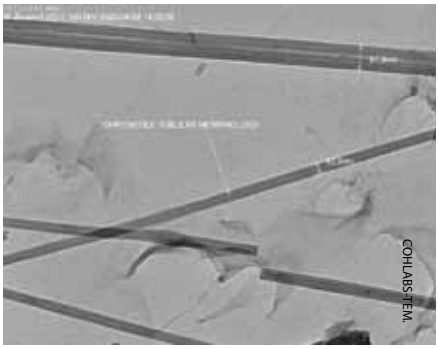
Due to the detrimental health effects of asbestos, it continues to be a prominent concern, highlighting the need for precise and dependable analytical methods to identify and measure its presence. Here Laurent Fenouil, Regional Manager at COHLABS-TEM, investigates the capabilities of transmission electron microscopy (TEM) in comparison to alternative techniques such as polarised light microscopy (PLM), phase contrast microscopy (PCM) and scanning electron microscopy (SEM).

A transmission electron microscope in the lab.



TEM observation of chrysotile asbestos fibre at a display magnification of 150,000x.

Transmission electron microscope principle

TEM is a highly capable imaging method that allows scientists to examine the internal structure of materials with remarkable resolution. Distinguishing it from alternative microscopy techniques, TEM utilises an electron beam instead of light to visualise the sample. As the electron beam passes through the extremely thin sample, it engages in interactions that provide detailed information about the sample's composition, crystal structure and morphology.

The analysis commences by meticulously preparing a small section of the asbestos-containing material and placing it onto a copper grid, facilitating its smooth transfer into the vacuum chamber of the microscope. Subsequently, the sample is exposed to a concentrated electron beam, and diverse detectors capture signals that unveil distinct characteristics of the sample's properties.

Comparing TEM against PLM, PCM and SEM

Within the array of analytical techniques, TEM stands apart due to its unmatched capability to offer comprehensive insights into asbestos fibres. While PLM, PCM and SEM are commonly utilised, they possess specific limitations that TEM successfully overcomes.

PLM

The combination of PLM with dispersion staining relies on the examination of asbestos fibres using polarised light, enabling the identification of fibre type through the analysis of morphological characteristics and crystalline structure.

Nevertheless, PLM may have limitations when dealing with non-commercial types of asbestos or other minerals that possess similar properties, resulting in inconclusive bulk results (referred to as unknown mineral fibres). Additionally, PLM's resolution limit of 0.2 µm hampers its ability to detect thin and short asbestos fibres that might be present in complex matrices such as vinyl tiles, putty samples, mastics, vermiculite, plasterboard and other non-fibrous materials, and "difficulties may occur in identifying fibres below about 1 µm width" as mentioned in *Asbestos: The Analysts' Guide*[1].

In both scenarios, TEM's capacity to detect these concealed asbestos structures guarantees a more thorough and precise evaluation of potential asbestos presence in building materials and natural samples.

PCM

The PCM method, employed for measuring airborne asbestos fibres, lacks the ability to distinguish between asbestos and non-asbestos fibres. As a result, it counts all fibre types in the sample, regardless of whether they are asbestos or not, leading to an overestimation of asbestos fibre concentrations.

Within the Australian regulatory framework, the NOHSC:3003[2] method utilises PCM to obtain counting results expressed as the number of fibres per millilitre of air. Subsequently, TEM analysis can be performed following the NIOSH 7402[3] method to identify the ratio in percentage of asbestos fibres on the same filter. This ratio is then applied to the PCM counts to calculate the actual concentration of asbestos fibres present in the air samples.

Nevertheless, PCM is limited by its reliance on light as a source, which poses constraints on its ability to observe objects smaller than 0.2 µm in diameter. Consequently, due to this resolution limit, the combination of results following the NIOSH 7402 method requires TEM to limit its observation exclusively on fibres >0.2 µm in width.

It is also important to note, as stated in ISO 10312 Ambient air — Determination of asbestos

fibres — Direct transfer transmission electron microscopy method, "Most fibres in ambient atmospheres are not asbestos and therefore, there is a requirement for fibres to be identified. Many airborne asbestos fibres in ambient atmospheres have diameters below the resolution limit of the optical microscope... [Transmission electron microscopy] has adequate resolution to allow detection of small fibres and is currently the only technique capable of unequivocal identification of the majority of individual fibres of asbestos."[4]

Through the utilisation of TEM, it becomes possible to attain a more precise and dependable estimation of asbestos concentration, thereby enhancing risk assessment and ensuring regulatory compliance.

SEM

Conversely, SEM offers high-resolution imaging of asbestos fibres and valuable surface information, in addition to chemical composition input when combined with energy dispersive X-ray spectroscopy (EDX-S), making it an excellent technique to discriminate cleavage fragments from asbestiform fibres of same composition. However, its resolution is limited by its image contrast[5,6] capability that may prevent it from visualising thin asbestos fibres. Furthermore, unless equipped with EBSD (electron backscatter diffraction), SEM cannot definitively identify and characterise the internal crystalline structure of the observed fibres, which can lead to result misinterpretation, as demonstrated in cases of talc contaminated with anthophyllite. In such instances, both minerals exhibit similar morphology and chemical composition, making differentiation difficult without examining their internal crystalline structure patterns.

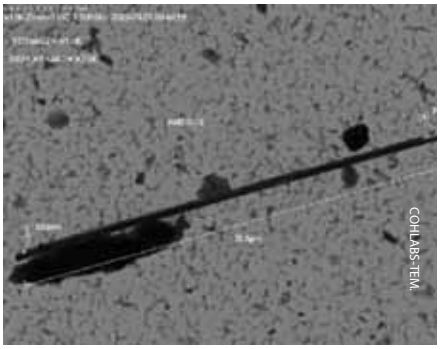
Three criteria for asbestos identification using TEM

TEM relies on three criteria to definitively identify asbestos fibres in both bulk and air samples.

Morphology

The first criterion employed by TEM involves examining the morphology of the observed fibre at high magnification to assess its asbestiform habit. This allows for differentiation between asbestos and non-asbestos fibres based on their characteristic features.

The crucial role of TEM in asbestos analysis lies in its ability to provide unique insights into the identification and characterisation of asbestos fibres.



TEM observation of amosite asbestos fibre.

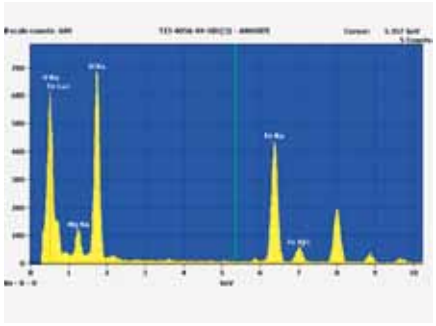
TEM observation of chrysotile asbestos crystalline structure by SAED.

Crystalline structure

The second criterion employed by TEM involves analysing the crystalline structure using selected area electron diffraction (SAED). This technique enables the assessment of fibre anisotropy. Asbestos fibres display a unique pattern of parallel rows with comet tail-like structures, which aids in their classification.

Chemical composition

Lastly, the chemical composition is examined using EDX-S. EDX-S analysis provides crucial information for identifying the precise type of asbestos among the six recognised forms.



TEM observation of amosite asbestos chemical composition by EDX-S.

Conclusion

The crucial role of TEM in asbestos analysis lies in its ability to provide unique insights into the identification and characterisation of asbestos fibres.

The combination of high-magnification morphology observation (exceeding 10,000x), SAED analysis for anisotropy determination, and EDX-S for chemical composition identification is essential for distinguishing numerous mineral fibres that resemble asbestos but are not hazardous.

TEM's high resolution and capability to detect thin and short asbestos fibres make it an indispensable tool for accurately assessing building materials, natural samples and air monitoring filters. This capability has contributed to the establishment of efficient standards in sampling, preparing and analysing asbestos by agencies like ISO, NIOSH (USA) and AFNOR (France) since the early 1990s.

In conclusion, the detailed examination of asbestos fibres by TEM establishes it as an indispensable tool for scientists and analysts, enhancing our ability to safeguard public health, provide accurate asbestos-related data, and improve risk evaluation and compliance.

1. https://www.hse.gov.uk/pubns/priced/hsg248.pdf
2. https://www.safeworkaustralia.gov.au/sites/default/files/2021-11/guidancenote_membranefiltermethodforestimatingairborneasbestosfibres_2ndedition_nohsc3003-2005_pdf.pdf
3. https://www.cdc.gov/niosh/docs/2003-154/pdfs/7402.pdf
4. https://www.iso.org/obp/ui/#iso:std:iso:10312:ed-2:v1:en
5. https://echa.europa.eu/documents/10162/4605fc92-18a2-ae48-f977-4dffdecfec11, p29
6. https://www.atsdr.cdc.gov/toxprofiles/tp61.pdf, p188

Breakthrough drug targets life-threatening 'bad cholesterol'

Researchers have trialled a new drug that is claimed to provide world-first treatment for lipoprotein(a), a largely genetic form of cholesterol that increases the risk of heart attack and stroke. High levels of lipoprotein(a), or Lp(a), impact one in five Australians, with no approved treatment currently on the market.

Lp(a) is similar to LDL cholesterol, sometimes called 'bad cholesterol', but is more sticky, increasing risk of blockages and blood clots in arteries. Common LDL-lowering drugs such as statins don't have the same lowering effect on Lp(a), and Lp(a) is also difficult to control through diet, exercise and other lifestyle changes due to its largely genetic nature.

Although Lp(a) was discovered nearly 60 years ago, there still aren't any widely accessible treatments available to lower levels and reduce cardiovascular risk. Researchers have been working on a targeted solution to treat elevated Lp(a) for the past decade, but advancements so far have been in difficult-to-administer injection-based therapies that are not yet on the market.

"When it comes to treating high Lp(a), a known risk factor for cardiovascular disease, our clinicians currently have no effective tools in their kit," said Professor Stephen Nicholls, Director of the Monash Victorian Heart Institute and The Victorian Heart Hospital.

Nicholls has been leading landmark research into muvalaplin — the first oral drug ever developed to target Lp(a), which works by disrupting the ability for Lp(a) to form in the body. The results of a recent first-in-human phase 1 trial, which were presented at the European Society of Cardiology

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Congress in Amsterdam and published in *JAMA*, show that the drug effectively lowered Lp(a) levels by up to 65% in healthy participants.

"This drug is a game changer in more ways than one," Nicholls said. "Not only do we have an option for lowering an elusive form of cholesterol, but being able to deliver it in an oral tablet means it will be more accessible for patients."

The trial was undertaken in collaboration with Cleveland Clinic and Eli Lilly, with the drug now set to continue into larger-phase clinical trials. It may also have potential to be used in the treatment of other vascular and valve diseases.

"Lp(a) is essentially a silent killer with no available treatment," Nicholls said. "This drug changes that."

Unreliable allergy tests spark call for standardisation

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Australian scientists are calling for the standardisation of allergy tests, after laboratory trials published in the journal *Allergy* showed that commercially available tests are not uniformly reliable.

As noted by study leader Dr Thimo Ruethers, from James Cook University's (JCU) Australian Institute of Tropical Health and Medicine and Tropical Futures Institute, food allergies pose major public health concerns, lower the quality of life and can be fatal. This is particularly the case with shellfish allergy, which affects up to 3% of the general population, is usually lifelong and commonly triggers anaphylaxis — a condition that leads to respiratory collapse.

"Skin prick testing (SPT) is often the preferred first-line diagnostic approach," said Professor Dianne Campbell from The Children's Hospital at Westmead. "This involves a health worker placing a drop of allergen extract on the surface of the arm then pricking through it into the arm. If you are allergic to the allergen you will have a small, itchy swelling and a reddening of the skin after 10–15 minutes."

But widely utilised allergen extracts in commercial SPT kits are generally not standardised, with JCU group leader Professor Andreas Lopata noting that researchers demonstrated "considerable variability in effectiveness" for 27 commercial SPT extracts for fish allergy in a 2019 study. This limits the diagnostic value of results.

"In the current study, using biochemical and immunological methods and mass spectrometry, we tested 11 commercial crustacean and five mollusc SPT extracts and found even greater, critical variability in their reliability," Lopata said.

Dr Thimo Ruethers presents the research findings published in Allergy.

The scientists concluded that some of the SPT extracts lacked the sufficient amount and diversity of important shellfish allergens, meaning test results could be falsely negative and putting lives at risk.

"Standardisation of allergen extracts is urgently needed to improve the accuracy and reliability of SPTs," Ruethers said.

"Also, improvements in blood tests, along with the development of region-specific allergen extracts with known quantities of clinically well-characterised allergen components, are critical to achieve considerable improvements in allergy testing."

UBC Forestry/Jillian van der Geest

Plants used to filter microplastics out of water

Could plants be the answer to the looming threat of microplastic pollution? Scientists at The University of British Columbia's (UBC) BioProducts Institute have found that if you add tannins — natural plant compounds that make your mouth pucker if you bite into an unripe fruit — to a layer of wood dust, you can create a filter that traps virtually all microplastic particles present in water.

Microplastics are tiny pieces of plastic debris resulting from the breakdown of consumer products and industrial waste. Keeping them out of water supplies is a huge challenge, according to Dr Orlando Rojas, the institute's scientific director, who noted one study which found that virtually all tap water is contaminated by microplastics.

"Most solutions proposed so far are costly or difficult to scale up," Rojas said. "We're proposing a solution that could potentially be scaled down for home use or scaled up for municipal treatment systems. Our filter, unlike plastic filters, does not contribute to further pollution as it uses renewable and biodegradable materials: tannic acids from plants, bark, wood and leaves, and wood sawdust — a forestry by-product that is both widely available and renewable."

For their study, published in the journal *Advanced Materials*, scientists at the BioProducts Institute and their collaborators analysed microparticles released from popular tea bags made of polypropylene. They found that their method, dubbed 'bioCap', trapped from 95.2% to as much as 99.9% of plastic particles in a column of water, depending on plastic type. When tested in mouse models, the process was found to prevent the accumulation of microplastics in the organs.

Rojas noted that it is difficult to capture all the different kinds of microplastics in a solution, as they come in different sizes, shapes and electrical charges. "There are microfibres from clothing, microbeads from cleansers and soaps, and foams and pellets from utensils, containers and packaging," he said. "By taking advantage of the different molecular interactions around tannic acids, our bioCap solution was able to remove virtually all of these different microplastic types.

While the experiment remains a lab set-up at this stage, the team is convinced that the solution can be scaled up easily and inexpensively once they find the right industry partner.

Quantum computer slows chemical process by factor of 100bn

Scientists at The University of Sydney have used a quantum computer to engineer and directly observe a process critical in chemical reactions by slowing it down by a factor of 100 billion times, in what is said to be a world first. Specifically, the research team witnessed the interference pattern of a single atom caused by a common geometric structure in chemistry called a 'conical intersection'.

In rapid photochemical processes such as photosynthesis, molecules transfer energy at lightning speed, forming areas of exchange known as conical intersections. Chemists have tried to directly observe such geometric processes in chemical dynamics since the 1950s, but it is not feasible to observe them directly given the extremely rapid timescales involved. As explained by joint lead researcher Vanessa Olaya Agudelo, "In nature, the whole process is over within femtoseconds. That's a billionth of a millionth — or one quadrillionth — of a second."

To get around this problem, the researchers created an experiment using a trapped-ion quantum computer — based in the Quantum Control Laboratory of Professor Michael Biercuk — in a completely new way. This allowed them to design and map this very complicated problem onto a relatively small quantum device — and then slow the process down by a factor of 100 billion. Their findings were published in the journal *Nature Chemistry*.

"Using our quantum computer, we built a system that allowed us to slow down the chemical dynamics from femtoseconds to milliseconds," Olaya Agudelo said. "This allowed us to make meaningful observations and measurements. This has never been done before."

Joint lead author Dr Christophe Valahu said the team's experiment was akin to simulating the air patterns around a plane wing in a wind tunnel. "Our experiment wasn't a digital approximation of the process — this was a direct analogue observation of the quantum dynamics unfolding at a speed we could observe," he explained.

By slowing down the dynamics in the quantum computer, the researchers revealed the telltale hallmarks predicted — but never before seen — associated with conical intersections in photochemistry. According to research team leader Associate Professor Ivan Kassal, "This exciting result will help us better understand ultrafast dynamics — how molecules change at the fastest timescales."

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Microplate thermoshaker

Compact and stylishly designed, the BioShake iQ high-end thermoshaker lets the user perform all their standard mixing runs with a minimum of adjustments. It offers high performance to handle a wide range of applications across biotechnology, pharmaceutical and academic research. Suitable for microplates, tubes and glass vials, the BioShake iQ is designed to offer fast and high-precision heating. With its stylish aluminium housing, it provides mixing from 200–3000 rpm and comes with a wide range of thermo adapters.

Users can save time by combining the gentle mixing of samples by orbital motion with the incubation phase, resulting in a higher throughput. The mixing orbit of 2 mm is always constant.

The orbital shaking is designed to be precisely controlled, so the user need never spin down their plates after mixing. Tubes, vials, high-density plates and low sample volumes offer no obstacle for these precision tools, the company says.

Using a large-area heating source in combination with digital sensors, the BioShake iQ heats from ambient to 99°C in a short amount of time, with features that provide ease of use, high levels of comfort and maximum safety.

Pacific Laboratory Products
www.pacificlab.com.au

Ultralow-temperature freezers

The MDF-DU703VH-PA VIP ECO SMART has been described by PHCbi as its most advanced ultralow-temperature freezer to date. The VIP ECO SMART has been found to use 30% less energy than other leading ENERGY STAR Certified freezers (based on independent third-party testing at time of publication), combining next-generation engineering with SMART control technology to provide a ULT freezer with high energy efficiency and enhanced security and operation. Frost mitigation technology additionally lowers the total cost of ownership.

The VIP ECO Natural Refrigerant -86°C Upright Freezer provides minimal environmental impact through natural refrigerants, efficient performance and the EZlatch system for energy efficiency. The robust refrigeration system provides dependable cooling and temperature performance through the PHC engineered heat transfer components and time-tested natural refrigerants. Reserve refrigeration power provides ultrafast temperature recovery following door openings.

Smart compressors, natural refrigerants and integrated electronics combine to lower facility operating costs. Freezer operation is managed by the practical balance of temperature performance and energy management.

The PHCbi cascade refrigeration platform is based on high-performance compressors designed by PHC specifically for ultralow-temperature applications. The PHCbi cascade system is used on VIP Series upright freezers for temperature storage preferences within a range of -50 to -86°C. These ULT lab freezers use two compressors in a cascade sequence. Both systems work together, running on refrigeration compressors designed to cool themselves as they operate to achieve ultralow temperatures.

Bio-Strategy Pty Ltd
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Electronic batch record execution module

Lonza has released the MODA-ES Module v4.0, an upgrade to its electronic batch record (EBR) module that enhances user experience and simplifies integration to expedite product release. The module represents the latest update to the MODA-ES Electronic Batch Record Execution Platform, which supports pharmaceutical companies in replacing paper-based processes with EBRs in the lab and on the production floor.

The improved module is designed to simplify processes, materials and item management, and to enhance batch tracking, approvals and external connectivity. It offers users an increased range of tools and functionality to streamline data capture and prevent errors, enabling quick delivery of medicines to the market.

As an end-to-end contract development and manufacturing organisation (CDMO), Lonza is well placed to identify key batch record issues facing manufacturers today. Such challenges include the need to streamline communications between manufacturing and quality control (QC) teams, and to minimise errors in paper-based records. The module addresses these challenges with a user-friendly, easy-to-deploy and configurable EBR system. It can enable users to eliminate labour-intensive, paper-based processes, helping to reduce errors, improve data integrity, accelerate review and approvals, and ultimately expedite product release.

The upgraded module builds on the strengths of the existing module, with new features including: robust weighing and dispensing capabilities to enable greater ease and precision; enhanced materials management for greater simplicity; improved user interface for seamless and intuitive browsing; and audit trail enhancements for deeper data contextualisation and at-a-glance updates.

Capsugel Australia Pty Ltd
lonzabioscience.com.au

Rapid test for dengue fever developed

Researchers from the University of the Sunshine Coast (UniSC) have developed a rapid portable test for one of the world's fastest-spreading mosquito-borne diseases, thanks to a grant of more than $150,000 from the Bill & Melinda Gates Research Foundation.

Dengue fever — a painful and deadly disease that infects up to 400 million people every year — is a viral infection that spreads to people from mosquito saliva infected with dengue viruses. There is no treatment other than for relief of symptoms, which include high fever, head and body aches, nausea and rash.

"We developed a rapid test, with results that look similar to a COVID-19 home stick test, for each of the four types of dengue virus," said grant recipient Dr Joanne Macdonald, who published her results on the open-access platform Gates Open Research.

Macdonald said the innovative method involved a reagent that inactivated the virus during amplification, enabling simpler, quicker and cheaper detection with a higher level of sensitivity than existing stick tests. These four tests were sensitive enough to detect even small amounts of viral genetic material in mosquitoes using only pipettes and a heating block, instead of expensive laboratory equipment.

"Our entire testing process took about 35 minutes on the spot, compared to hours of travel time and PCR processing required for current sampling," Macdonald said.

"In practical terms, people and authorities in areas with few resources can set a trap and test mosquitos each week, to check whether dengue is present.

"It has the potential to make mosquito screening more accessible, enhancing surveillance and control efforts in countries where dengue is endemic."

Study co-author Dr Nina Pollak has since published a collaborative paper investigating the potential of using the tests to detect dengue in human serum, plasma and blood. This paper also supported the advantages of the new method.

"Our tests provided performance and speed without compromising specificity in human plasma and serum and could become promising tools for the detection of high dengue loads in resource-limited settings," Pollak said.

The team's next goal is to combine each test for the four dengue serotypes into a single test, to further streamline detection. Co-author Dr Madeeha Ahmed said the tests aim to lay the groundwork for future studies focused on actual use and effectiveness in the field.

WA developing a 10-Year Science and Technology Plan

WA's Department of Jobs, Tourism, Science and Innovation (JTSI) is leading the development of a new strategic 10-year Science and Technology Plan for Western Australia (The Plan), which aims to establish the state as a global hub for leading and inclusive science and tech research, development, commercialisation and deployment. The Plan will complement current strategies such as Western Australia's Innovation Strategy, which establishes a 10-year vision to make WA a renowned global hub of invention, investment, innovation and impact.

The Plan seeks to define pathways to capitalise on the state's unique advantages, and attract investment and talent to maximise impact. It will highlight WA's key strengths — including those in radio astronomy, space operations, remote technologies, marine science, medical technology and food security — as well as opportunities for sustainable living and energy transition, preparedness for AUKUS Pillar II critical technologies and advanced manufacturing.

The blueprint will investigate how science and technology can provide solutions to current and future challenges — from diversifying and decarbonising the economy, to finding new medical solutions, to improving the quality of life of Western Australians. The contribution of First Nations peoples to scientific discovery and advances will also be acknowledged, facilitating greater support for future engagement and endeavours.

"The Cook government's 10-Year Science and Technology Plan will elevate Western Australia as an exciting global hub of science and technology development," said WA Science Minister Stephen Dawson. "It will acknowledge our huge capabilities and expertise in areas such as emerging tech, food security, energy transition and security, the circular economy, First Nations knowledge and more.

"Building the state's science and technology capability for the next decade is essential for the future. These industries will help diversify and decarbonise the WA economy, create exciting jobs and help us to solve challenges faced by communities around the world."

Broad consultation with stakeholders, including industry, research institutions, Aboriginal groups, government agencies and universities, commenced in September, to establish an inclusive and impactful plan by 2024. To register your interest in being involved, email sciencetechplan@jtsi.wa.gov.au.

Optical emission spectrometers

The Thermo Scientific ARL iSpark Plus Optical Emission Spectrometer range is designed to streamline elemental analysis in the metal production, processing and recycling industries, as well as in contract and research labs. The spectrometers offer metal producers, processors and recyclers — as well as contract and research labs — the rapid spectral analysis needed to achieve key productivity, quality and environmental objectives.

The range builds on the legacy of Thermo Fisher's flagship ARL iSpark range, combining state-of-the-art technologies, user-friendly features and advanced automation algorithms to enable the wide-range spectral analysis of metal samples and ultrafast detection of non-metallic inclusions. The ARL iSpark Plus line adds an improved spark stand to extend maintenance intervals by 30%, minimise signal drift for most elements and provide virtually no memory effect from preceding samples. Other benefits include high-sensitivity photomultiplier tube optics, digital spark generation, single spark acquisition, smart argon management and advanced data collection technologies.

The increased analytical speed and stability of the spectrometers allows steel plants and foundries to minimise tap-to-tap times, save energy, reduce carbon footprints and realise a fast return on investment.

Thermo Fisher Scientific
thermofisher.com

Intrinsically safe humidity and temperature transmitter series

The intrinsically safe HMT370EX is suitable for monitoring relative humidity and temperature in hazardous areas, zones 0 to 20. The transmitters can also output other humidity measurements, including dewpoint temperature, wet-bulb temperature, absolute humidity, mixing ratio, water concentration, water mass fraction, water vapour pressure and enthalpy. In pharmaceutical applications, explosion-proof refrigerators and freezers are often used to store organic culture media. IS transmitters are also useful in powder granulation and coating rooms.

Because the probe cable lengths are adjustable, measurement probes can be placed at some distance from the transmitter. Flexible probe placement makes the transmitter suitable for monitoring in hard-to-reach locations. The entire HMT370EX transmitter can be installed directly in hazardous areas. It can withstand continuous exposure to potentially explosive environments that contain flammable gases or dust. In addition, operation in either gaseous or dusty environments requires no additional protective enclosures.

The HMT370EX has been released with numerous certificates for intrinsically safe compliance, including ATEX, IECEx, CML, NEPSI, KC, FM, MET, CSA and UKEX.

Vaisala Pty Ltd
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Human cell (HEK293) expressed cytokines and growth factors with high bioactivity

HumanKine recombinant proteins from Proteintech are created in HEK293 cells using animal-free components.

Proteins co-expressed in bacteria will not possess post-translational modifications such as phosphorylation or glycosylation. For activity, many proteins require these modifications and the processing which is only available in eukaryotic systems; specifically human systems for authentic human proteins.

All Humankine recombinant proteins are produced in Proteintech's in-house cGMP-grade laboratory adhering to strict quality control regulations. This also allows for seamless transition from research-grade to cGMP.

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

TEER measurement instrument

World Precision Instruments (WPI) has launched the latest member of its EVOM family of products, the EVOM Auto. The product enables rapid and reproducible measurements of transepithelial electrical resistance (TEER), a well-established and widely accepted method of evaluating epithelial and endothelial cells and tissues, in vitro.

WPI's EVOM Auto combines TEER technology with high-throughput screening capabilities, resulting in the automated measurement of resistance in 96-well cell culture plates. This data gives scientists and drug discovery laboratories insights into tissue and monolayer barrier integrity, cell permeability and cell confluency, and can read out the critical physiology of barrier tissues such as the blood–brain barrier, the gastrointestinal tract, the lung and the skin.

Coherent Scientific Pty Ltd
www.coherent.com.au

NIST reference materials to help combat seafood fraud

If you purchase seafood marked as wild-caught salmon, how do you know that you're not actually getting cheaper farm-raised salmon, or even an entirely different kind of fish? Researchers at the US National Institute of Standards and Technology (NIST) are helping to address this concern with the development of new salmon and shrimp reference materials, now available through the NIST Store.

Farm-raised (aquacultured) salmon and shrimp are typically less expensive to produce compared to wild-caught, which require more resources, such as fuel for boats. If producers substitute farmed shrimp for wild-caught, they can earn higher profits at a lower cost. The new reference materials can help food inspectors assess the authenticity of seafood, which can then help verify where the seafood was caught or produced.

In addition to being useful for industrial food labs, the reference materials will help the US Food and Drug Administration (FDA) and US Customs and Border Protection agencies assess whether imported salmon and shrimp are authentic. As noted by NIST biologist Debra Ellisor, "There was interest expressed by stakeholders, including customs officials, about the authenticity of seafood products. When we receive imported goods, how do we know they are what they claim to be?"

In order to develop the reference materials, the NIST researchers needed to get seafood from verified sources. They worked with the National Oceanic and Atmospheric Administration (NOAA) Northwest Fisheries Science Center Marine Forensic Laboratory to obtain salmon off the coast of Alaska as well as farm-raised salmon from a river-based aquaculture facility in Washington state. They also collaborated with NOAA researchers at the Hollings Marine Laboratory to get authentic wild-caught shrimp samples off the coast of South Carolina and aquacultured shrimp from a land-based facility in Alabama.

To make the reference materials, the researchers cut their samples into small pieces which undertook a process called cryomilling, where they were ground down while simultaneously cooled with liquid nitrogen, turning them into a fine powder. The materials were then bottled in glass jars, tested and analysed for attributes including their fatty acid profiles, crude protein levels and the specific chemical compounds in each material.

The reference materials help to authenticate shrimp and salmon in different ways. "For shrimp," Ellisor said, "genetic analysis methods are used because wild-caught shrimp species that are found in the US market or industry are not typically found in the US aquaculture market. The species will tell you the source."

For salmon, scientists can look at an analysis of the ratios of omega-3 to omega-6 fatty acids found in the salmon's flesh. The aquacultured salmon reference materials have twice the amount of omega-3 fatty acids compared to wild-caught.

"We know research shows fatty acid profiles differ in salmon," said NIST chemist Benjamin Place. "The measurement itself is straightforward. Most food labs can use that method. If it's not accurate or precise, they may not be able to tell the difference between the two.

The wild-caught and farm-raised salmon and shrimp were cut into smaller pieces so they could be processed further for testing.

D Ellisor/NIST.

D Ellisor/NIST.

The researchers obtained farm-raised coho salmon from an aquaculture facility in Washington state and wild-caught coho salmon off the coast of Alaska

"If we can recognise a benchmark of wild-caught or aquaculture salmon, then we can give that to the labs," Place said. Scientists in industry can ultimately use the reference materials to validate their methods, Ellisor added.

The reference materials can additionally be used for food safety and detecting allergens, as well as testing for metals or other contaminants. They also come with a certificate of analysis, which contains genetic information on the shrimp and salmon.

"If a food processing place can use the reference material to say this is the species that it is, then consumers can have more confidence," Place said. "You now know when you go to a store, you can have full faith the seafood product is the species it says it is and that the labels are true."

Anion exchange purifier

The 3M Polisher ST is a fully encapsulated single-use anion exchange (AEX) product intended to reduce host cell protein (HCP) impurities, viruses and other negatively charged contaminants in flow-through polishing chromatography of biopharmaceutical process streams. It is a synthetic, hybrid purifier containing two complementary AEX-functional media: a quaternary ammonium ('Q') functional nonwoven and a guanidinium (Gu) functional membrane.

Ion exchange chromatography is a commonly used downstream polishing purification technique in the production of mAbs and many other therapeutic proteins. The limitation with traditional anion exchange chromatography is that the binding capacity is diffusion-limited and the interaction strength of the ligand depends on operating conditions like pH and conductivity.

The 3M product, with its nonwoven and membrane skeletons, provides mechanical strength and durability, while the grafted hydrogel functionality creates a large three-dimensional surface area that contains a high density of functional groups with interconnected pores allowing for convective flow channels that are able to achieve high flow rates. The high density of binding sites, together with a macroporous structure, enables high binding capacity for not only HCP, but also large molecules, such as viruses and DNA. The high density of binding sites and low residence time also results in high mAb recovery (>95%).

The high ligand density on the advanced anion exchange membrane provides robust impurity removal and viral clearance. It also provides a 50 to 100x higher mAb load capacity than chromatography resin beads, the company says, which allows further reduction of the media volume requirement. The impurity clearance performance (HCP≤1000 ppm, ≤100 ppb DNA, and viral clearance) is independent of the load up to 10 kg/m^2, enabling downsizing of the unit operation.

Other benefits include: operation in robust process conditions (pH 5 to 9 and conductivity 3 to 20 mS/cm); HCP reduction of >60% in phosphate buffer, >22% in citrate buffer; virus reduction >4-log; DNA clearance down to LOD levels (~0.05 ppb DNA); ease of use due to elimination of column packing, unpacking, cleaning and storage; and downstream process intensification through a combination of high flow rates with high binding.

3M Australia - Separation & Purification Sciences
www.3mpurification.com.au

Microinjectors

WPI's new-generation pressure injectors are quickly replacing the legacy line of pneumatic valve PicoPump pressure injectors, the PV820 and PV830 having been a staple in the microinjection market for decades.

The company's three latest injectors facilitate any type of microinjection that involves glass micropipettes. They are the MICRO-ePUMP Microinjector with an integrated cell penetrator and internal pressure source; the μPUMP Microinjector with internal pressure source; and the PV850 Microinjector for use with external pressure sources.

WPI Microinjectors use carefully regulated air pressure for injecting cells with fluid. Injected volumes range from picolitres to nanolitres. The port supplies positive pressure for high-pressure ejection. The pressure port maintains a low positive 'compensation' pressure to the injecting pipette between injection pulses to prevent fluid uptake through capillary action.

The WPI Microinjectors are designed to inject very small quantities of fluids, such as drugs, into cells or small organelles. Pressure injection is an especially useful alternative to electroionophoresis, since it does not mandate the use of charged ions. Two different positive pressures may be applied: one for ejection at high pressure and a second, lower pressure to prevent back filling of the pipette by capillary action.

Coherent Scientific Pty Ltd
www.coherent.com.au

Molecular filter

Camfil's CamCarb XG is a versatile, ergonomic and corrosion-resistant filter suitable for supply, recirculation and exhaust air systems in commercial, industrial and process applications. Its conical shape enables high removal efficiency while maintaining low-pressure drop.

The filter's patented design maximises adsorbent media utilisation, resulting in an overall lighter-weight filter with a longer lifetime compared to the previous-generation cylinder. This lowers the total cost of ownership (TCO).

Along with improved filter performance, the product features robust construction and is incinerable, with no adhesive used in construction, no degradation of media and negligible outgassing. It is fillable with a wide range of molecular filtration media for various applications.

CamCarb XG can be installed in supply, recirculation and exhaust air systems. When mounted in the holding frame, all internal leaks are eliminated for high-efficiency operation. The product can also be supplied in Camfil's air cleaners with a molecular module or in a CamCube/GlidePack housing.

Two-stage filtration is available as an option, with a mounting rail for 48 mm particle pre- or after-filters. Housings are used in comfort and industrial applications.

Camfil Australia Pty Limited
www.camfil.com/en-au

The Game-Changer
in Pharmaceuticals and Nutraceuticals Preservation

Exploring the Advantages of Low-Temperature Spray Drying in Drug and Supplement Preservation

Fluid Air is introducing Australian businesses to the exceptional benefits of low-temperature spray drying. Our technology outperforms traditional heat drying methods by preserving the bioactivity and potency of active ingredients.

A branch of Spraying Systems, Fluid Air champions spray drying technology that is proven to produce superior quality powder. This is achieved by removing moisture at low temperatures within a nitrogen-rich environment. Such a method not only prolongs the shelf life of pharmaceuticals and nutraceuticals but also safeguards their inherent bioactivity.

Dr. Bogan Zisu, Fluid Air's Global Research Head, states, "Our technologies are particularly advantageous for heat-sensitive compounds commonly found in drugs and supplements. The low-temperature processing we employ ensures minimal bioactivity loss."

Fluid Air's innovative process includes an electrostatic charge during drying, ideal for preserving essential oils and lipid-based compounds present in many nutraceuticals.

Highlighting the nitrogen-rich environment of their drying procedure, Dr. Zisu mentions, "Traditional drying methods often compromise the quality of sensitive pharmaceuticals by using excessive heat. Our approach keeps these compounds intact by using lower temperatures."

Dr. Zisu sheds light on a study where a nutraceutical company, with a product rich in volatile compounds, witnessed a remarkable retention rate of up to 60% using Fluid Air's technology. Such effectiveness showcases the potential of Fluid Air's machinery in revolutionizing the pharmaceutical and nutraceutical sectors.

Enhancing Bioactivity Retention in Pharmaceuticals and Nutraceuticals

The innovative technology developed by Fluid Air was initially conceptualized for a food industry challenge. Yet, its efficacy soon garnered attention from pharmaceutical and nutraceutical manufacturers.

Dr. Zisu remarks, "Many nutraceuticals use encapsulation techniques, especially for lipid-based compounds. Our electrostatic spray dryer was co-developed with industry partners to address this need."

Most pharmaceuticals and nutraceuticals are presented in powder form due to its compatibility with both water-soluble and lipid-soluble compounds. "Powdered forms are stable, easier to handle, and reduce shipping costs significantly," Dr. Zisu adds.

The Prominence of Low Temperatures in Spray Drying

For pharmaceuticals and nutraceuticals, the stability of the active compounds is paramount. Factors like temperature and oxygen levels significantly influence this stability. Dr. Zisu notes, "Our cooler drying temperatures favour the retention of sensitive compounds, thus maximizing the product's bioactivity."

Fluid Air's nitrogen-based method restricts oxygen during processing, boosting the shelf life and preserving the bioactivity of drugs and supplements.

Fluid Air: Pioneering Change in Pharmaceuticals and Nutraceuticals

Recently, the traction from Australian SMEs and start-ups in the pharmaceutical sector has been overwhelming. "Most inquiries are from emerging businesses exploring the benefits of this technology," observes Dr. Zisu.

For businesses aiming for international markets, Fluid Air's approach ensures products remain potent throughout prolonged transits, even under varying temperatures.

We can test your product

We have a fully functioning testing facility at our Melbourne lab. We know you want to see results before making such a large purchase and we can work with you to prove our results before you purchase our Polar Dry technology.

For clients interested in experiencing the prowess of the Polar Dry® technology, Fluid Air, along with Spraying Systems Australia, extends a hands-on approach through their Melbourne Testing Facility. Mark Condro, Fluid Air Business Development Manager, encourages potential clients to explore their technology. He says, "We are confident in the transformative potential of our technology, especially for the pharmaceutical and nutraceutical sectors."

Dr. Zisu concludes by emphasizing the extensive capabilities of their Melbourne lab. "From converting liquid compounds into powder to analyzing pre-drying and post-drying properties, we are fully equipped."

From targeted pharmaceutical solutions to comprehensive nutraceutical products, Fluid Air's technology is adaptable, scalable, and exceptionally efficient. For more details, contact mark.condro@spray.com.au

Spraying Systems Co.®

Spraying Systems Co Pty Ltd
www.fluidairinc.com.au

Microbial cell counter

Counting and identifying bacterial cell samples reliably can be challenging. Bacteria are an incredibly diverse group of organisms that come in multiple shapes, sizes and arrangements, making detailed assessment a difficult process. While manual cell counting of bacterial colony forming units (CFUs) remains a typical practice in laboratories, it is time-consuming, labour-intensive and provides only an estimate of the viable cells present. Even expensive flow cytometers and laser scanning cytometers still register each particle, single or clustered, as a single event. Mammalian cell counters typically are unsuitable given the small size of bacterial cells.

Logos Biosystems' QUANTOM Tx offers a solution to these challenges with rapid bacterial quantification. QUANTOM Tx is an automated fluorescence-stained microbial cell counter with fluorescence imaging and analysis that counts bacterial cells as small as 0.3 μm, in around 30 s/sample.

Image-based analysis enables direct counting without the need for overnight culturing. Sophisticated counting algorithms allow single bacteria-cell detection regardless of genome size, morphology, cell size or motility, and even in the tightest of clusters. In addition, a special kit for counting viable bacterial cells overcomes variability. Stained cells are loaded into cell counting slides and spun in the QUANTOM Centrifuge to immobilise and evenly distribute cells to provide appropriate cell counts.

With QUANTOM Tx users can: count bacterial strains that are not culturable in lab conditions; remove user-to-user variation; analyse multiple fields of view with no need for estimation based on turbidity or CFUs; use an easy-to-follow protocol and autofocus; and assess fluorescence stains for either total count or viable count information.

ATA Scientific Pty Ltd
www.atascientific.com.au

Microplate reader for endotoxin and pyrogen testing

Lonza has launched the Nebula Absorbance Reader, an absorbance microplate reader that joins the company's portfolio of optimised instruments for streamlined endotoxin and pyrogen testing.

Pharmaceutical quality control (QC) laboratories worldwide rely on the traditional absorbance-based Limulus amebocyte lysate (LAL) and Tachypleus amebocyte lysate (TAL) assays to assure the safety of raw materials in process samples and manufactured products. However, the industry-standard absorbance reader for these assays — the ELx808 Absorbance Microplate Reader (ELx808) — will no longer be sold by Lonza from late 2023. The Nebula Absorbance Reader represents a high-performance replacement reader, designed to deliver results comparable to those typically found with ELx808 and to facilitate the smooth continuation of current pyrogen and endotoxin testing programs.

Designed for use alongside Lonza reagents, the microplate reader is optimised to work with, and meet all the specifications of, the company's absorbance-based endotoxin assays such as the Lonza PYROGENT 5000 Turbidimetric and Kinetic-QCL Chromogenic Endotoxin Assays. The reader also supports the readout for monocyte activation tests (MAT) such as Lonza's PyroCell MAT System. It features high-performance optics and monochromator-based wavelength selection to enable precise measurements of endotoxin levels, with a compact design that requires minimal laboratory space and allows for workflow flexibility.

The reader is fully integrated with the latest version of Lonza's WinKQCL Endotoxin Detection and Analysis Software (v6.4), enabling users to meet the latest data integrity requirements. This reduces training burdens by removing the need for existing WinKQCL Software users to learn new software in order to use the reader. The product is also similar in design and build to the Nebula Multimode Reader — using the same user manual, the same service tools, and similar qualification procedures — which simplifies system maintenance.

Capsugel Australia Pty Ltd
lonzabioscience.com.au

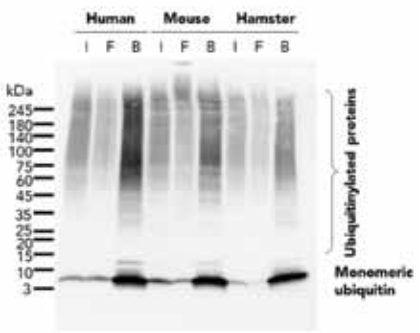
High-affinity ubiquitin trap for immunoprecipitation

The ChromoTek Ubiquitin-Trap consists of an anti-ubiquitin nanobody/VHH, coupled to either standard agarose beads or magnetic agarose beads. It is designed to overcome the lack of specificity that can be encountered when using conventional antibodies to isolate and detect ubiquitin.

The Ubiquitin-Traps can be used for immunoprecipitation of ubiquitin and ubiquitinylated proteins from mammalian, yeast and plant cell extracts. Lysine-linked ubiquitin chains are also compatible with the Ubiquitin-Trap range of products.

The traps are also available in kits containing all reagents needed to complete a full IP workflow. Components include lysis, RIPA, wash, dilution and elution buffers.

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



Enhancing liquid measurement precision with Coriolis sensor-based mass flow meters and controllers

Precise liquid measurement, regulation and dispensing are essential in a range of industries, including pharmaceuticals and biotechnology processes, and in food processing and chemical processes for precise dosing. It is also important in other manufacturing processes such as thin-film coating, and in the production of fuel cells, electrolysers and batteries.

In many of these applications high precision is required at very low flow rates. In these cases, mass flow meters and controllers based on the Coriolis principle have a number of advantages.

The Coriolis measurement principle

The Coriolis measurement principle involves an excitation coil setting a measurement tube into high-frequency oscillation. When a liquid flows through the oscillating tube, the Coriolis force acts upon the liquid, leading to a phase shift — the difference in tube oscillation between its start and end. Sensors measure the phase shift, which is directly proportional to the mass flow rate.

The Burkert Type 8756 Mass Flow Meters and Mass Flow Controllers (MFM/MFC), based on the Coriolis principle, are particularly suitable for the very precise measurement or control of small quantities of liquid that also require a medium-separated sensor.

The Type 8756: both a flow meter and a controller

The heart of the Type 8756 is its Coriolis sensor — featuring a slender measurement tube with a diameter of DN1 — which forms the basis for a range of configurations, including mass flow meters (MFM) and mass flow controllers (MFC).

Available in two sizes (Size 1 for up to 25 kg/h flow rate and Size 2 for up to 120 kg/h), the Type 8756 can be a flowmeter, or a controller available in a number of variants:

- With an interface for a modular actuator that is suitable for applications up to 100 bar pressure.
- With an integrated proportional valve.
- With an integrated high-precision micro-annular gear pump that is self-priming and hermetically sealed.

The variant with an integrated pump is used as a control or dosing system for liquids that have to be conveyed from an unpressurised container.

The sophisticated design of the Type 8756, coupled with a high excitation frequency, renders the device highly resilient to external vibrations, and since it lacks moving parts within the medium, has high durability. It can accommodate fluids with high density and viscosities of up to 200 mPa-s and can be calibrated using water, regardless of the application.

Because of the Coriolis principle, pressure and temperature deviations have no impact on the measuring accuracy. In addition to the flow rate, the density and temperature of the liquid are also measured. The device design enables a stable flow measurement that is immune to external impacts and does not require a zero-point adjustment when the process conditions change. All materials that come into contact with the medium are highly resistant and enable use with a variety of liquids, whether aggressive or neutral media.

Integrated batch control

In addition to continuous flow measurement and regulation, the Type 8756 offers a variant with integrated batch control capabilities. Precision is paramount in dispensing and filling applications, where even minor variations can lead to quality issues. With the integrated batch controller, this device ensures consistent dosing regardless of temperature or pressure fluctuations, offering a dosing accuracy of approximately 0.3% of the measured value. Every dosing event is documented, enabling efficient monitoring and reproducibility of the process.

The Type 8756 Coriolis MFM/MFC with its robust Coriolis sensor is a game-changer in liquid measurement and control. Its adaptability, precision, and durability make it an indispensable tool in a wide array of industries, ensuring consistent and reliable performance in challenging environments. Whether the application is in pharmaceuticals, food production, or chemical processing, the Type 8756 offers a reliable solution for any liquid measurement need.

For more information, please visit www.burkert.com.au/en/type/8756.

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FLUID CONTROL SYSTEMS

Burkert Fluid Control Systems
www.burkert.com.au

Maintaining image integrity

The importance of quality control in scientific images

Maintaining integrity is critical in upholding public trust in science and credibility in the scientific community. Principal investigators (PIs) work diligently to ensure all the information published by their team is accurate, but reviewing every image produced by the lab is a definite challenge. Dr Dror Kolodkin-Gal, virology and cancer researcher and founder of image integrity software company Proofig, explores how image issues occur and how PIs can more easily manage image integrity.

iStock.com/fotosipsak

In a laboratory setting, the PI is typically responsible for ensuring that the research they and their team share is credible, repeatable and accurate, across both written content and images. But although PIs recognise the importance of maintaining image integrity, they usually find it difficult to effectively perform the image analysis needed before publication. Instead, PIs may only have time to carry out inspections by eye.

Manually checking for image integrity issues is a long, daunting and arduous process that often results in failure. Before submitting the research to a potential publisher the PI must not only review each image to look for minute duplications between one or two images, but check every image against itself and every other image included in the research. So if the paper contains 100 images, that could equate to about 10,000 comparisons. This is not a task for a person without the aid of computational capabilities, even if they have plenty of spare time.

As instances of retractions caused by image duplications and manipulations become more prevalent, PIs must consider how to ensure the entire laboratory prioritises image integrity.

The image integrity problem

Failing to identify image integrity issues prior to submission, be it for grant applications or publication, can lead to rejection. Alternatively, if an integrity issue remains undetected during review but is later reported either to the journal or online, the publisher is usually obligated to conduct an investigation.

Many in the scientific community believe that there is no malicious intent within their lab, and therefore a low risk of retraction due to image issues. Indeed, image integrity issues are often due to honest mistakes. But the investigation process can take years, as forensic investigators look at the allegation, the research origins and suspected outcomes — during which time researchers may encounter challenges in securing further funding, carrying out research or finding alternative publishing avenues. Consequently, regardless of the investigation's outcome, researchers must work hard to rebuild their reputation.

According to leading image data integrity analyst Jana Christopher MA, between 20 and 35% of manuscripts are flagged for image-related problems[1]. While some of these issues are due to deception or misconduct, research suggests that fabricated content only accounts for a small portion of image issues reported. This was evidenced during a trial that ran from January 2021 to May 2022, where the American Association of Cancer Research (AACR) used Proofig's automated image integrity software to screen 1367 papers accepted for publication[2]. Of those, 208 papers required author contact to clear up issues such as mistaken duplications, and only four papers were withdrawn. In almost all cases (204 cases), there was no evidence of intentional image manipulation.

How image issues occur

PIs and their teams must increase awareness throughout the lab of any potential image issues that can occur, particularly unintentionally, to reduce the risk of paper retractions and corrections post publication.

Research teams can take various measures to mitigate duplication, but completely avoiding this is not always possible, especially because minute issues are difficult to detect by eye. When collaborating on research, it can be particularly difficult to ensure good image management during the experimental phase across a wider team.

Consider this example. A cancer researcher is looking to study the efficacy of a treatment for pancreatic cancer. This involves looking at cross-sections of pancreas in a slide, reviewing a control sample alongside samples with different concentrations of the treatment. Over the entire experiment, the researcher may be required to collect hundreds to thousands of images of specimens. If imagery of the entire slide is unclear when examining specimens under the microscope, the researcher may move the lens and change magnification to capture different areas of the pancreas in detail. Depending on the magnification, the researcher may need to move the microscope from left to right and up and down to document every section of the slide.

If a paper is published with two overlapping parts of an image used, with scaled versions (taken by different lens magnifications) or with an image that was mistakenly saved twice with different names, the researchers and the PI could not notice these errors and their paper may be flagged for image duplication. Unfortunately, the microscope itself does not alert researchers to potential overlaps when capturing images, so researchers may unintentionally duplicate some images.

The future of image integrity detection

PIs can no longer rely purely on traditional, manual checks. Many are therefore considering how to streamline the review process by introducing proactive quality control measures that reduce the risk of image issues.

The good news is, advancements in AI and computer vision have led to the development of valuable tools for scientists. Researchers and publishers can now use online tools to check their content for grammar, readability and plagiarism. Similarly, publishers and researchers can now use software to automate the image checking process.

AI image proofing software can be trained to automatically scan images in a paper, checking each against itself and others in the paper to flag any anomalies. PIs can use the software to review all the research produced by the team, rapidly generating reports that outline any potential issues. These issues can then be investigated further by the PIs, who can pinpoint their origins.

If the detected error needs attention, the PI and their team can hold off until the paper is as accurate as possible. This ensures a higher standard for the paper and the conclusions of the experiments. Therefore, the AI-driven approach not only optimises the verification process, it also contributes significantly to enhancing the overall quality and reliability of scientific research publications.

Improving awareness and providing support about image integrity can help a PI minimise the risk of their research team introducing image issues to their manuscripts from the outset. Implementing quality control procedures and using the right quality control software for both text and images prior to paper submission is currently fundamental to safeguarding the reputation of the team and their manuscripts.

By understanding how image duplications occur, and establishing processes to more easily detect issues, PIs and their teams can ensure image integrity throughout the research and publication process.

1. https://ukrio.org/ukrio-resources/expert-interviews/jana-christopher-image-integrity-analyst/
2. https://www.theregister.com/2022/09/12/academic_publishers_are_using_ai/

Veterinary LIMS

Autoscribe Informatics' laboratory information management system (LIMS), Matrix Gemini, is used by veterinary laboratories across the world for managing the full testing life cycle, from sample reception to final reporting. The Matrix Gemini Veterinary LIMS has now been updated to support the specific needs of veterinary pathology labs.

Multiple species-specific limits can be assigned to each test, reducing the burden of supporting multiple species and breeds. Instead of creating multiple versions of the same test, with different limits for each species, the software allows multiple limits, one for each species, to be applied to the same test.

Other features include: predefined templates for culture and sensitivity testing to help identify effective antimicrobials, a key aspect of ensuring effective treatment; the ability to pool samples for testing and maintain traceability, enabling a whole herd or flock to be tested at once; and optional support for manual differential testing, allowing technicians to view a slide or plate through their microscope while simultaneously recording counts on a keyboard.

Matrix Gemini is known for its configurability. Every custom LIMS is based on the same software, with configurable workflows and screen designs to suit any industry. The graphical configuration tools allow controlled changes to be made to the system without the need for software coding. This means the system can be modified over time to meet changing business requirements, without compromising system support or upgradeability of the core code.

Autoscribe Informatics Pty Ltd
www.autoscribeinformatics.com.au

IP66/IP69K stainless steel panel PC

Interworld Electronics has introduced the PhanTAM-921C series of rugged, stainless steel panel PCs from APLEX Technology. The PhanTAM-921C series improves on previous solutions, with an updated Intel 11th Gen Core i3 (Dual Core)/i5 (Quad Core) processor, ultraslim front frame design, landscape or portrait mode, and waterproof antenna covers, which removes the risk of bending/breaking antennas.

The PhanTAM-921C series offers a highly protective panel solution, going beyond the basic standard, by achieving IP66 and IP69K-certified protection with M12 connectors. The 304 (or optional 316) fully enclosed stainless steel chassis makes the PhanTAM-921C series a good solution for the food and beverage manufacturing industry due to its slim design, high corrosion resistance and germ resistance, helping to prevent any bacterial contamination. The use of stainless steel for the chassis also makes it easy to clean (capable of withstanding high-pressure cleaning), increases the life cycle of the chassis due to its rugged nature, and helps to lower the cost of maintenance.

The PhanTAM-921C series features a 21.5″ TFT-LCD display, and includes two USB, one serial and one LAN port, as well as the ability to add additional ports, Wi-Fi and RFID. The addition of waterproof antenna covers enables companies to make use of a range of antenna options (4G LTE, 5G, BT and Wi-Fi).

The PCAP touch screen with 7H anti-scratch surface, and optional high brightness, helps to improve usability and makes it adaptable to a range of environments.

Interworld Electronics and Computer Industries
www.ieci.com.au

EMCCD camera with high sensitivity

The Evolve 16 is a high-resolution, back-illuminated EMCCD camera from Teledyne Imaging providing the highest sensitivity in the Evolve range for low-light applications such as single-molecule imaging, TIRF microscopy and more.

Features include an active array size of 512 x 512 EMCCD, 16 μm pixel size, a frame rate of 61 fps, 11.6 mm field of view and 95% quantum efficiency.

When a scientist can count their photons on one hand, they need the lowest noise possible. Alongside back-illumination for maximum quantum efficiency, the Evolve uses electron multiplication to achieve a read noise as low as 0.25e- without sacrificing frame rate.

Through their single output amplifier, EMCCDs offer uniform noise performance across the sensor. This is advantageous for analysis in many single-molecule fluorescence imaging techniques.

The camera fine-tunes the performance of EMCCD sensors to provide high image quality through careful electronic design and calibration.

SciTech Pty Ltd
www.scitech.com.au

Small-scale bioreactor helps create cultivated meat

Life science equipment supplier Getinge understands the importance of ongoing investment in technologies and novel approaches. Consequently, the company embraced the opportunity to support innovative food company Magic Valley, whose scientists have utilised an Applikon bioreactor in the process of creating cultivated meat that is completely free from animal by-products.

Magic Valley is an Australian company cultivating real meat products grown from a living animal. After taking a skin biopsy from the animal, the skin cells are taken to the company's Melbourne lab, where they are cultured in media that is free of foetal bovine serum and reprogrammed into induced pluripotent stem (iPS) cells.

iPS cells can grow in an unlimited and scalable way, multiplying quickly and at a substantial volume — more so than other cell types, so no further skin scrapings need to be taken. The cells can be made into muscle and fat — the main components of meat — and the Magic Valley team can even enhance the nutritional profile of their meat.

Eric Honroth, President of Life Science at Getinge, visited Magic Valley's Melbourne facility in August to observe the Applikon bioreactor in action, as well as to sample one of the company's cultivated pork dumplings. The Applikon MiniBio with my-Control was used by Magic Valley to help develop process and optimisation of the initial stages during the expansion of the iPS cells.

The Applikon MiniBio is a true scale-down of the classic laboratory-scale bioreactor. It has the same flexibility as other models, which means that it can be customised to fit the demands of any process. The small volume reduces media costs and maximises usage of bench space.

The my-Control controller is suitable for small-scale cultivations as it requires less bench space than other controllers. The advanced system can control single- and multi-use bioreactors from 50 mL (working volume) up to a total volume of 3 L for both cell culture and microbial cultures.

Dr Vijay Kumar, Senior Bioprocess Engineer at Magic Valley, said he appreciated the fact that the Applikon MiniBio comes in both single-use and multi-use formats, as well as the customisable aspect.

"I think those are two particularly attractive aspects of the vessel we're currently using, but also its user friendliness," Kumar said. "It's very easy to set up and is basically plug and play.

"So those would be the key things that make this one [bioreactor] particularly attractive, because we could just get pretty much anyone trained up in the lab to operate it almost overnight."

Head of R&D Professor Andrew Laslett added, "It actually seems really simple to use in terms of the interface. The number of sensors that are available are quite good."

Kartik Natarajan, MD Getinge Australia & New Zealand, concluded, "We see a huge opportunity in the laboratory space with our bioreactor products. A result of the pandemic has been an increase in research funding by the Australian and NZ governments with regard to vaccines and other diseases, so the demand for our products continues to increase. And that's not to mention a whole range of other adjacent opportunities in labs, such as lab-grown meats."

The jars contain various cell wall precursors that the Bonn researchers isolated for analysis, including the target structures of clovibactin.

Photo ©Gregor Hübl/University of Bonn

New antibiotic

sourced from 'microbial dark matter'

A powerful new antibiotic, dubbed 'clovibactin' and isolated from bacteria that could not be studied before, seems capable of combating harmful bacteria and even multi-resistant 'superbugs' in an unusual manner, making it more difficult for the bacteria to develop any resistance against it.

Antimicrobial resistance is a major problem for human health, and researchers worldwide are looking for new solutions. However, the discovery of new antibiotics is a challenge: few new antibiotics have been introduced over the last decades, and they often resemble older, already known antibiotics.

Clovibactin was discovered by NovoBiotic Pharmaceuticals, a small US-based early-stage company, and microbiologist Professor Kim Lewis from Northeastern University in Boston. They had previously developed a device that enables researchers to grow microbial dark matter, which are so-called unculturable bacteria. (Interestingly, 99% of all bacteria are 'unculturable' and could not be grown in laboratories previously, and therefore not be mined for novel antibiotics.)

Using their device, called iCHip, the US researchers discovered clovibactin in a bacterium isolated from a sandy soil from North Carolina: *E. terrae ssp. Carolina*. Since clovibactin was isolated from bacteria that could not be grown before, pathogenic bacteria have not seen such an antibiotic before and have had no time to develop resistance.

In a study published in the journal *Cell*, NovoBiotic Pharmaceuticals showed that clovibactin successfully attacks a broad spectrum of bacterial pathogens. It was also successfully used to treat mice infected with the superbug *Staphylococcus aureus*.

Clovibactin appears to have an unusual killing mechanism. It targets not just one, but three different precursor molecules that are all essential for the construction of the cell wall, an envelope-like structure that surrounds bacteria. This was discovered by the group of study co-author Professor Tanja Schneider, from the University of Bonn.

"The multi-target attack mechanism of clovibactin blocks bacterial cell wall synthesis simultaneously at different positions," Schneider said. "This improves the drug's activity and substantially increases its robustness to resistance development."

How exactly clovibactin blocks the synthesis of the bacterial cell wall was unravelled by a team led by Dr Markus Weingarth at Utrecht University. They utilised solid-state nuclear magnetic resonance (NMR) spectroscopy, which allows clovibactin's mechanism to be studied under similar conditions as in bacteria.

"Clovibactin wraps around the pyrophosphate like a tight glove, like a cage that encloses its target," Weingarth said. Furthermore, clovibactin only binds to the pyrophosphate that is common to cell wall precursors, ignoring that variable sugar-peptide part of the targets.

"As clovibactin only binds to the immutable, conserved part of its targets, bacteria will have a much harder time developing any resistance against it," Weingarth said. "In fact, we did not observe any resistance to clovibactin in our studies."

Furthermore, upon binding the target molecules, clovibactin self-assembles into large fibrils on the surface of bacterial membranes. These fibrils are stable for a long time and thereby ensure that the target molecules remain sequestered for as long as necessary to kill bacteria.

"Since these fibrils only form on bacterial membranes and not on human membranes, they are presumably also the reason why clovibactin selectively damages bacterial cells but is not toxic to human cells," Weingarth said. "Clovibactin hence has potential for the design of improved therapeutics that kill bacterial pathogens without resistance development."

SPONSORED CONTENT

Unravelling the Mysteries of Proteins: Meet Aurora, by RedShiftBio

Researchers constantly seek advanced technologies to better understand the intricacies of proteins, and one such groundbreaking innovation is the RedShiftBio Aurora Microfluidic Modulation Spectroscopy (MMS) System.

Protein structure is directly related to its function in cells, and so understanding protein structure is crucial in many fields ranging from drug development to food science. The ability to detect the slightest changes in biomolecule higher-order structure allows the identification of the molecules, formulations, and conditions which are most likely to lead to stable drug and food products.

Traditionally, protein analysis has been a complex and time-consuming process, often requiring large sample quantities and intricate procedures. This challenge has spurred scientists to seek innovative solutions, and the Aurora MMS System by RedShiftBio is at the forefront of this protein analysis revolution.

The Aurora MMS System: A Game Changer in Protein Analysis

Aurora is powered by Microfluidic Modulation Spectroscopy (MMS) and provides ultra-sensitive, ultra-precise structural analysis of a wide range of biomolecules like proteins, peptides, antibodies, mRNA, ADCs, and AAVs. It measures structural changes due to buffer/pH/formulation, stress, point mutations, binding partners, and storage conditions. When compared to CD or FTIR, MMS can detect structural change 20x faster and with 30x greater sensitivity[1]. MMS combines a high-power Quantum Cascade Laser with real-time buffer referencing. This provides the power to analyse both low- and high-concentration samples, in formulation buffer without excipient interference, to detect small but critical structural changes.

The Benefits of Aurora MMS

What sets this system apart is its ability to perform these analyses with minimal sample requirements (50µL of sample), high sensitivity and exceptional accuracy — all within an automated space-saving unit that is simple to operate. The Aurora MMS system provides a wealth of information about the protein's secondary structure, allowing users to gain insights into its folding, stability, and conformation. Proteins can be analysed at concentrations as low as 0.2 mg/mL to >200 mg/ml, a capability that was once considered impossible with traditional methods.

The Science Behind Aurora MMS: How It Works

Microfluidic Modulation Spectroscopy (MMS) technology combines mid-infrared laser spectroscopy with microfluidics, built-in real time referencing and advanced signal processing to provide high sensitivity measurements with no buffer interference. The tuneable laser in the secondary structure analysis tools probes the protein solution through a microfluidic cell. Sample and reference (buffer) streams rapidly alternate to continuously allow background subtraction, dramatically improving measurement precision, accuracy, and signal-to-noise.

Structure, Stability, Similarity, and Stress Characterisation of a commercial mAb and Two Biosimilar Drugs Using MMS — presented at Formulation and Delivery 2023 in San Diego!

Biologic drugs are complex and difficult to replicate, however, a biosimilar can be approved if it is shown to be highly similar to the originator. In this study, MMS was used to: 1) show the structural similarity between a commercial mAb and two research-grade biosimilar drugs, 2) compare their structure in different formulations, and 3) test their stability under different stress conditions. None of the three drugs showed structural differences in different buffers, but heat stress had a greater structural effect on the commercial mAb in PBS than in formulation buffer. Future work will replicate the heat stress study with the biosimilars to understand their thermal stability (https://bit.ly/3PLCfe8).

In a world where proteins are the key to unlocking scientific mysteries and therapeutic applications, the Aurora MMS System is illuminating the path toward a brighter and more informed future. With its capacity to reveal the hidden secrets of proteins, it stands as a testament to the power of MMS technology and the potential for advancing protein therapeutics. To request a demo, proof-of-concept, or a discussion on how MMS can enhance your research or product development goals, please contact ATA Scientific at +61 2 9541 3500 or enquiries@atascientific.com.au.

1. Journal of Pharmaceutical Sciences, Jan 2020

ATA Scientific Pty Ltd
www.atascientific.com.au

Peter Philipp, ANZ General Manager, Neo4j

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Transforming life sciences and health care with graph technology

Life sciences and health care involve increasingly vast amounts of data that contain valuable insights to improve health and treatment outcomes. But storing, mining and analysing this information is increasingly beyond the scope of traditional databases and analytics tools.

This is where graph technology can play a critical role. It can help life sciences users — pharmaceutical companies, chemical manufacturers, biotech startups and healthcare providers — integrate and analyse large, complex datasets, leading to better drug discovery, disease diagnosis and personalised treatments.

In traditional data systems, data is typically organised into tables with rows and columns. This works for storing and querying structured data but struggles with complex datasets. Graph technology is a specialised data system representing data points as nodes and links to show their relationships. They're ideal for querying huge, highly interconnected data, making it possible to traverse relationships quickly and answer complicated queries.

This presents a range of applications for the healthcare sector that can help solve complicated life sciences problems at every scale in the following areas:

1. Drug discovery

In traditional drug discovery, researchers typically screen large libraries of compounds against a single target protein or pathway. This often fails to consider the complex interplay between various proteins and pathways within the body. With graph data science, an analytics and machine learning (ML) solution, the complex interactions

between biological molecules can be modelled and analysed, making it easier to identify potential drug targets and predict the effects of different drugs.

GSK, formerly GlaxoSmithKline, is leveraging knowledge graphs to improve clinical reporting workflows, answer critical scientific questions and manage drug discovery projects. A knowledge graph connects and contextualises various data structures and formats to unearth relationships and make more informed predictions and decisions.

GSK spends tremendous time processing data through its life cycle, from initial collection to study and reports and, ultimately, submission. Much of this data has traditionally been held in isolated silos, in complex programmatical scripts, making it very difficult for non-programmers to understand and for researchers to connect and analyse. Instead, GSK is moving away from isolated data domain silos to a single, contextualised Clinical Knowledge Graph that anyone can easily follow.

2. Precision medicine

Graph data science can enable much more personalised and targeted treatment plans based on a patient's unique genetic and biological makeup. A graph can be constructed of an individual's genomic data and analyse data from other sources such as electronic health records and wearable health tracking devices. This can help identify risk factors and deliver highly personalised treatment plans.

In GSK's case, its patient-centric data graph will integrate all these different sources, providing rich contextual knowledge into an individual patient's situation. This will lead to accelerated decision-making — critical for optimal patient care — and enables greater control over data privacy and patient consent.

3. Disease diagnosis

Graph technology offers a more holistic approach to disease diagnosis, making it easier to analyse biological data and uncover patterns and connections between biological markers and symptoms. For example, by building a graph of gene expression data from patients with a specific disease, researchers can identify gene expression patterns associated with the disease and key genes and pathways that may be involved.

DZD, the German Center for Diabetes Research, uses graph technology to bridge different datasets and find treatment measures for diabetes across multiple disciplines. Scientists can examine the disease from many different angles to better understand diabetes' causes, asking questions in natural language such as: "Can a specific change be attributed to a healthier diet, a drug or a hitherto unknown factor?"

4. Healthcare analytics

Health data comes from various disparate sources, such as electronic medical records, claims and patient-generated data. These can be connected in a graph along with other data sources, such as social determinants of health or environmental factors. This may reveal potential links between these factors and possible interventions to improve health outcomes by addressing the underlying factors.

Novartis has used graph technology to combine its data with medical information from the National Institutes of Health's PubMed. It contains 25 million abstracts from around 5600 scientific journals, connecting linked genes, diseases and compounds in a triangular pattern. Researchers can then make queries such as: "I want to find compounds similar to this compound that have annotations about this disease".

Graph technology is a powerful tool for life sciences analytics that allows researchers to model and analyse complex interactions between different variables and outcomes in healthcare data. By uncovering patterns and connections that may not be apparent through traditional approaches, graph technology can result in more targeted and effective healthcare interventions, improving patient outcomes and reducing costs.

Analyser for on-demand protein titre measurements

Protein titre measurements are a key parameter to monitor bioprocess reactors, but until now obtaining them has required sending samples for analysis by HPLC, often requiring many hours or even days before results are returned. Now, users without chromatography experience can get the titre measurements they need on-line or at-line in minutes, generating actionable results and optimising the utilisation of the bioreactors. This allows for more efficient use of resources and can lead to cost savings.

The HaLCon Analyser is an advanced, fit-for-purpose, liquid chromatography platform designed to provide protein titre results equivalent to traditional protein A, HPLC with a faster and easier platform method. The analyser integrates seamlessly into any bioprocessing suite without disrupting existing workflows or equipment and requires no chromatography expertise.

The HaLCon Analyser fills a key gap in the tools available to scientists and technicians in bioprocess development and manufacturing, allowing protein titre to be measured routinely and easily. It makes it possible for users without advanced HPLC training to obtain an equivalent protein titre measurement in under 5 min right at the point of need, allowing for efficient use of bioprocess reactors and freeing up valuable HPLCs and highly trained analysts to run more complex experiments.

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www.atascientific.com.au

X-ray diffractometer

The Thermo Scientific ARL X'TRA Companion X-ray Diffractometer has been launched to support routine phase analysis for quality monitoring in any laboratory. The benchtop θ/θ Bragg-Brentano X-ray diffractometer has been designed to provide precision, safety and ease of use in a compact, low-maintenance design that can be easily incorporated into any setting. Its solid state 2D detector means high-resolution data is collected within minutes, to support efficient and informed process control and consistent product quality.

The latest in Thermo Fisher Scientific's X-ray diffraction (XRD) product line, the instrument enables rapid and comprehensive analysis of phases in a wide range of samples, from clinker to battery materials. Its advanced detector and precision optics provide high-resolution data, enabling users to carefully monitor the quality and consistency of their processes, manage costs of productions and comply with current regulations. Efficient sample loading and intuitive software streamline the workflow to improve throughput and productivity, while automated transmission of results to a laboratory information management system provides efficient and secure data management.

The diffractometer is designed to provide phase analysis in any laboratory, including in cement, ore mining and battery material production. Key features include: a sample changer allowing high-throughput analysis of sample batches; intuitive software that makes the instrument accessible to operators of varying skill levels with minimal training; mineral analysis allowing identification of polymorphisms, such as C3S M1/M3 in clinker, to monitor quality and process efficiency; XRD and X-ray fluorescence analysis to improve interpretation of results; remote diagnostics to enable a quick response to any issues detected; a robust design to reduce downtime and maintenance costs; and backing by Thermo Fisher's high-level support services to maximise uptime and workflow compliance.

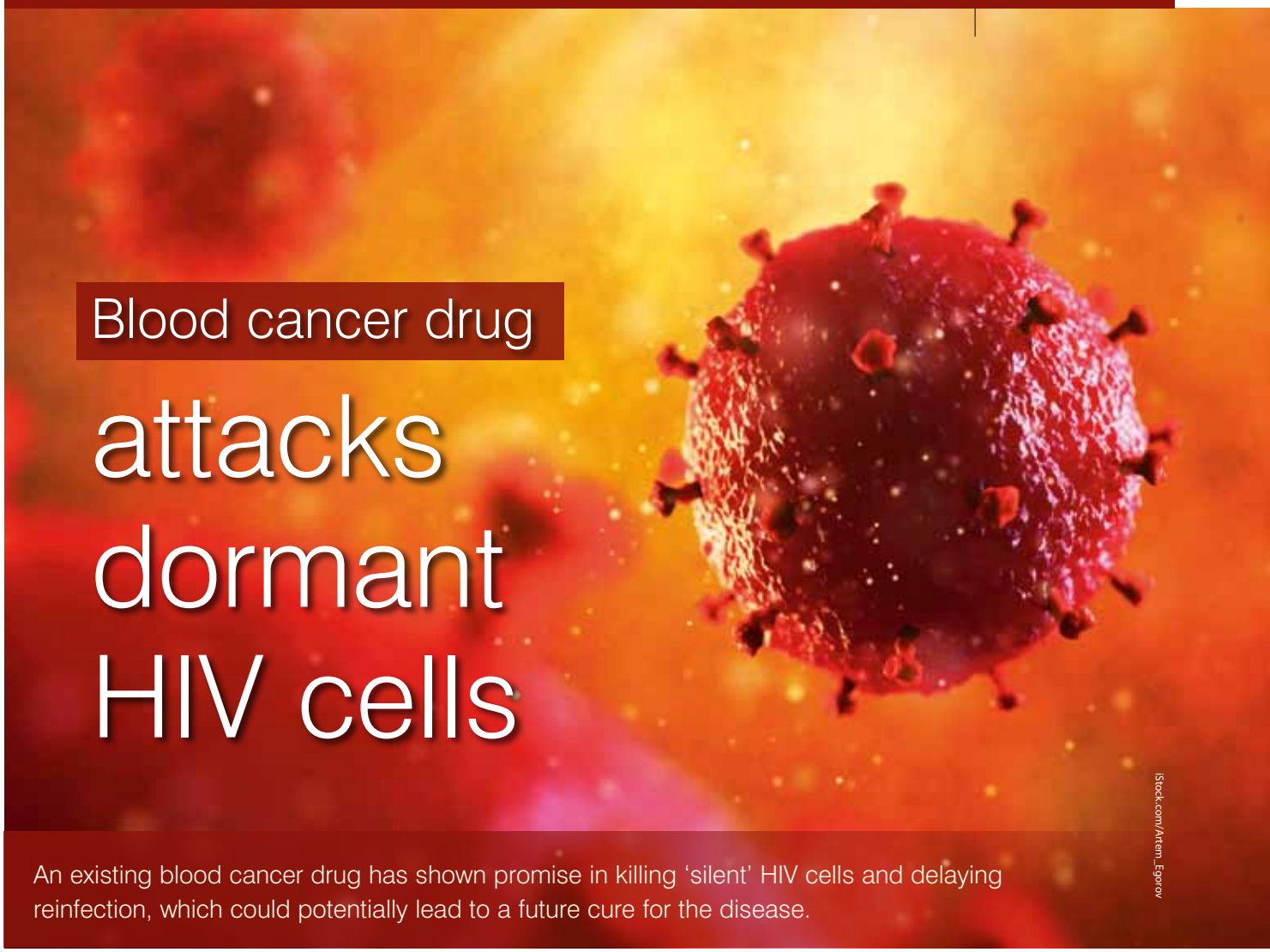
Thermo Fisher Scientific
thermofisher.com

Multipurpose scale

Pacific Laboratory Products has an economical scale from Ohaus available for basic weighing needs. The Valor 1000 Series V11P3T is suitable for food preparation and portioning applications, with standard features including a large (250 x 180 mm) removable stainless steel weighing platform for easy cleaning; checkweighing mode for quick weight checking; and the freedom of portability, provided by its long-lasting (100 h) internal rechargeable battery.

The product has a maximum capacity of 3 kg; readability of 0.5 g; dimensions measuring 110 x 250 x 307 mm; net weight of 3.2 kg; and linearity ±0.5 g. Other features include: tare range by subtraction up to capacity; dual backlit LCDs (front and rear); an AC adapter; external calibration software; selectable environmental settings; selectable weighing units; and operating temperature from 0–40°C, 80% RH, non-condensing.

Pacific Laboratory Products
www.pacificlab.com.au



Blood cancer drug attacks dormant HIV cells

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An existing blood cancer drug has shown promise in killing 'silent' HIV cells and delaying reinfection, which could potentially lead to a future cure for the disease.

HIV primarily targets CD4+ T cells, a type of white blood cell crucial for the immune system to properly function. It is within these cells that HIV can lie dormant, ready to reactivate if the virus is not effectively suppressed.

These hibernating, infected cells are the reason why people living with HIV require lifelong treatment — antiretroviral therapy (ART) cannot target these cells, meaning it can only suppress the virus rather than cure it. If a person stops taking their medication, the hibernating cells will reactivate within a very short time frame, leading to a resurgence of the virus.

In a new study, published in the journal *Cell Reports Medicine*, researchers at the Walter and Eliza Hall Institute of Medical Research (WEHI) used the cancer drug venetoclax on enhanced preclinical models of HIV and found it delayed the virus from rebounding by two weeks, even without ART. As noted by co-first author Dr Philip Arandjelovic, "In attacking dormant HIV cells and delaying viral rebound, venetoclax has shown promise beyond that of currently approved treatments."

He added, "Every achievement in delaying this virus from returning brings us closer to preventing the disease from re-emerging in people living with HIV. Our findings are hopefully a step towards this goal."

The study marks the first time venetoclax has been used on its own to assess HIV persistence in preclinical models. However, the researchers also found the cancer treatment can be combined with another drug that acts on the same pathway and is currently in clinical trials, to achieve a longer delay in viral rebound, with a shorter duration of venetoclax treatment.

"It has long been understood that one drug may not be enough to completely eliminate HIV," Arandjelovic said. "This finding has supported that theory, while uncovering venetoclax's powerful potential as a weapon against HIV."

As part of the same study, scientists at The Peter Doherty Institute for Infection and Immunity studied human CD4+ T cells donated by people living with HIV who are on suppressive ART, finding that venetoclax was also able to reduce the amount of HIV DNA in these white blood cells. Co-first author Dr Youry Kim, a postdoctoral researcher at the Doherty Institute, said venetoclax potently reduced the amount of intact viral DNA in patient cells when studied in the laboratory.

"This indicates that venetoclax is selectively killing the infected cells, which rely on key proteins to survive," Kim said. "Venetoclax has the ability to antagonise one of the key survival proteins."

A Phase I/IIb clinical trial using venetoclax to treat HIV will start at the end of the year in Denmark, with plans to expand the study to Melbourne in 2024. To be co-led by Doherty Institute Director Professor Sharon Lewin, the trial will replicate the preclinical study to assess safety and tolerability in people living with HIV who are on suppressive ART.

"It's exciting to see venetoclax, which has already helped thousands of blood cancer patients, now being repurposed as a treatment that could also help change the lives of people living with HIV and put an end to the requirement for lifelong medication," Lewin said.

Flow switch and monitor

In a range of industries, the close control of toxic and/or combustible gases requires the continuous monitoring of analysers to ensure their safe, effective use to protect employees and assure product quality. Fluid Components International's FS10A Analyzer Flow Switch/Monitor is a sophisticated universal flow switch and monitor specifically designed for gas and liquid process analyser sampling systems.

Utilising FCI's thermal dispersion flow measurement technology, the device is designed with proprietary equal mass sensing to achieve good sensitivity and repeatability. The instrument's wetted parts are corrosion-resistant 316L stainless steel with Hastelloy C-22 sensor tips. The sensor element has no moving parts to foul, clog or maintain. There are no cavities, orifices or dead-legs to trap or contaminate samples, which preserves sample integrity and enables fast sampling times.

The instrument's remote configuration is Div 1/Zone 1 FM approved for hazardous environments. The remote configuration is useful when the sensor's installation area is subjected to high temperatures or for mounting directly to the front panel of the analyser, placing its display in a more convenient location for technician viewing.

The fast-responding, repeatable device is designed with an easy-to-read, top-mounted, flow rate monitoring LED array for at-a-glance visual indication of operational status of proper flow rate to the analyser or sampling system, or that an alarm/trip point has occurred. The flow switch's set-point is user-settable via two push-buttons accessible at the top of the unit or via the RS232C I/O port.

The product is suitable for use with nearly all types of process and emissions sampling systems, including gas chromatographs (GCs), mass spectrometers, optical spectrometers, photometers and others. Standard configurations will accommodate standard 1/8″, 1/4″, 3/8″ and 1/2″ tubing as well as the SP76 (NeSSi) modular manifold. In addition to its SIL-2 rating, the product features global hazardous area operations approvals including ATEX, CE, CRN, EAC/TR CU, FM, FMc and IECEx for use in Div 2/Zone 2 environments.

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

Bead mill homogeniser

Capella Science has partnered with OMNI to introduce the Bead Ruptor 24 Bead Mill Homogeniser (19-070) in order to drive performance and cost efficiencies for 2 mL tube users. Designed with a fixed 2 mL tube carriage, the powerful device processes volumes from 200 µL–2 mL tubes and is an economical solution for 2 mL tube users.

With speeds of up to 6.5 m/s, the Bead Ruptor 24 Bead Mill Homogeniser's performance decreases processing time and reduces sample heating to maximise sample preparation efficiency. Compatible with the Bead Ruptor Cryo Cooling Unit, it is suitable for a variety of applications including DNA/RNA extraction, tissue homogenisation, enzyme isolation, cell lysis and protein purification.

A range of 2 mL pre-filled bead mill tubes are available for different sample types to enable consistent sample homogenisation. From its programmable memory to its multilingual user interface and convenient front-loading design, the homogeniser is designed to optimise tube motion, reduce swirling and offer some of the highest bead impact forces of any bead mill on the market.

Key system highlights include a fixed 2 mL tube carriage for processing 24 tubes per cycle; compatibility with the Bead Ruptor Cryo Cooling Unit; performance range up to 6.5 m/s in increments of 0.15 m/s; programmable touchscreen; run time from 1 s to 9:59 min; 200 µL to 2 mL processing volume; and locking safety lid.

For research use only. Not for diagnostic procedures.

Capella Science
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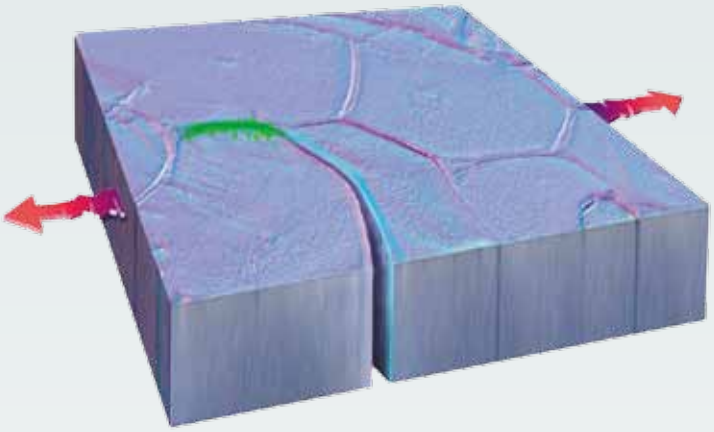
Scientists witness metal healing itself



Green marks the spot where a fissure formed, then fused back together in this artistic rendering of nanoscale self-healing in metal, discovered at Sandia National Laboratories. Red arrows indicate the direction of the pulling force that unexpectedly triggered the phenomenon.

Image credit: Dan Thompson

Scientists from Sandia National Laboratories and Texas A&M University have witnessed pieces of metal crack and then fuse back together without any human intervention, overturning fundamental scientific theories in the process.

If this newly discovered phenomenon could be harnessed, it could usher in an engineering revolution — one in which self-healing engines, bridges and airplanes could reverse damage caused by wear and tear.

Fatigue damage is one way machines wear out and eventually break. Repeated stress or motion causes microscopic cracks to form; over time, these cracks grow and spread until the whole device fails.

"From solder joints in our electronic devices to our vehicle's engines to the bridges that we drive over, these structures often fail unpredictably due to cyclic loading that leads to crack initiation and eventual fracture," said Sandia materials scientist Brad Boyce. "When they do fail, we have to contend with replacement costs, lost time and, in some cases, even injuries or loss of life."

Although scientists have created some self-healing materials — mostly plastics — the notion of a self-healing metal has largely been the domain of science fiction. As noted by Boyce, "Cracks in metals were only ever expected to get bigger, not smaller. Even some of the basic equations we use to describe crack growth preclude the possibility of such healing processes."

From theory to reality

In 2013, Michael Demkowicz — then an assistant professor at Massachusetts Institute of Technology, now a full professor at Texas A&M — published a theory in *Physical Review Letters*, based on findings in computer simulations, that under certain conditions metal should be able to weld shut cracks formed by wear and tear. The discovery that his theory was true came inadvertently at the Center for Integrated Nanotechnologies, a Department of Energy user facility jointly operated by Sandia and Los Alamos national laboratories.

Khalid Hattar, now an associate professor at the University of Tennessee, and Chris Barr, who now works for the Department of Energy's Office of Nuclear Energy, were running an experiment at Sandia when the discovery was made. They only meant to evaluate how cracks formed and spread through a nanoscale piece of platinum using a specialised electron microscope technique they had developed to repeatedly pull on the ends of the metal 200 times per second.

Surprisingly, about 40 minutes into the experiment, the damage reversed course. One end of the crack fused back together as if it was retracing its steps, leaving no trace of the former injury. Over time, the crack regrew along a different direction.

"This was absolutely stunning to watch firsthand," Boyce said.

"What we have confirmed is that metals have their own intrinsic, natural ability to heal themselves, at least in the case of fatigue damage at the nanoscale."

Boyce, who was aware of Demkowicz's theory, contacted the professor to share the team's findings. Demkowicz then recreated the experiment on a computer model, substantiating that the phenomenon witnessed at Sandia was the same one he had theorised years earlier.

A lot remains unknown about the self-healing process, including whether it will become a practical tool in a manufacturing setting. As noted by Boyce, "We show this happening in nanocrystalline metals in vacuum, but we don't know if this can also be induced in conventional metals in air."

Yet for all the unknowns, the discovery — which has been published in the journal *Nature* — provides a leap forward for the field of materials science. Demkowicz concluded, "My hope is that this finding will encourage materials researchers to consider that, under the right circumstances, materials can do things we never expected."

Advancing food science with microfluidic modulation spectroscopy

An interview with Dr Woojeong Kim

Most journeys in scientific research begin with curiosity and a hunger to make a meaningful impact on humanity. Here Dr Woojeong Kim, a passionate researcher in the field of food science and engineering, shares her inspiring journey and remarkable contributions made in the realm of food research.

From utilising traditional Chinese food for novel applications to revolutionising protein analysis with cutting-edge technology, Kim and her research group are driving a food transformation as the world looks for a more sustainable food system that tastes good too. This article explores Kim's journey into science, her passion for research, and the transformative role of microfluidic modulation spectroscopy in her work.

From yuba to groundbreaking research

During her master's studies, Kim identified a novel application of yuba, a traditional Chinese food for meat packaging. This discovery ignited a passion for food research.

"When I found out that traditional Chinese food could be used for other purposes, I was excited to work more on research to benefit humanity from food production to consumption," Kim said.

The journey continued as Kim pursued a PhD, during which she explored the potential of plant-based proteins and their applications. Her thesis, titled 'Pea/whey protein complexes for microencapsulation of lipophilic bioactive compounds', earned her the prestigious Dean's Award at UNSW. Her passion for the subject propelled her to new heights, being named a finalist for the IChemE Global Award in the Young Researcher category. Kim eagerly anticipates presenting her latest work in Japan after being selected as one of the 2023 Rising Stars Asia to attend Asian Deans' Forum 2023 – The Rising Stars Women in Engineering Workshop, hosted by The University of Tokyo.

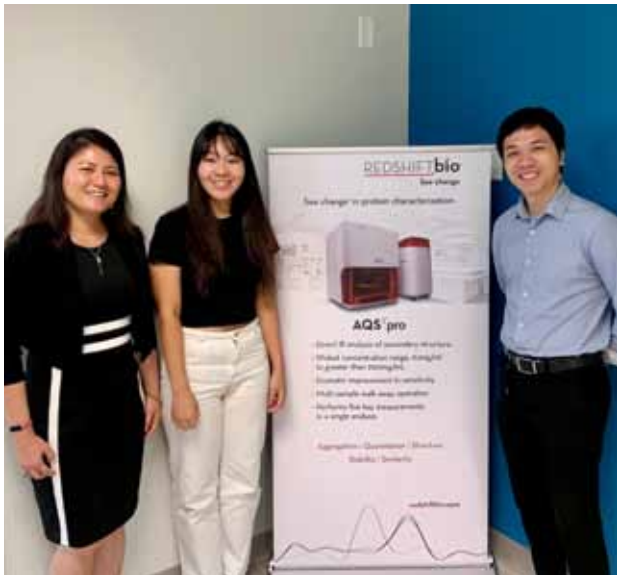
"The most enjoyable aspect of my work is the opportunity to try new things and discover groundbreaking findings daily," Kim said. "I find great satisfaction in applying cutting-edge technologies to analyse food samples and publishing the results in scientific journals."

Unveiling the future of food

Kim's focus on plant-based foods is a rapidly growing sector that poses unique challenges due to the differences in characteristics between plant-based and animal-based products. At the heart of her research is processing technologies used to enhance the functionality of plant proteins. Led by Professor Cordelia Selomulya, her research group focuses on food engineering, functional dairy and food products, and particle technology. They emphasise the importance of exploring food ingredients from plant sources, aligning with the growing trend towards plant-based alternatives in the food industry.

Recent experiences, such as a visit to the IFT FIRST Annual Event and Expo, further fuelled Kim's passion for sustainable food processing technologies and leveraging food waste to create valuable ingredients.

"With the ever-growing world population, food research has become crucial for addressing the complicated challenges associated with food production, distribution and consumption," Kim said. "Research on plant-based foods is critical in



shaping the future of food production, advancing human health, addressing environmental concerns and promoting sustainability."

Revolutionising protein structural analysis: the RedShiftBio MMS technique

In 2021, Kim encountered microfluidic modulation spectroscopy (MMS) when searching for a suitable method to characterise the protein secondary structure during her PhD project on cross-linking of pea/whey protein complexes. Struggling with traditional analysis methods like FT-IR and circular dichroism spectroscopy, Kim sought a more accurate and effective solution for characterising protein secondary structure.

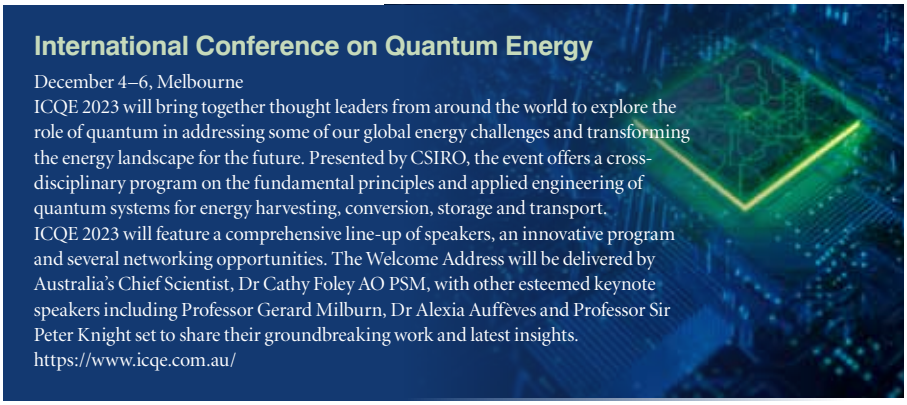
Through the StructIR Lab Grant program from RedShiftBio, Kim gained access to MMS technology using the AQS3pro instrument. She found that this marked a major leap forward in food analysis by offering unparalleled accuracy and the ability to analyse a wide range of protein concentrations. Her findings were published in a scientific journal, *Food Bioscience*, and are believed to have made history as the first application of MMS in food analysis in early 2023.[1]

"I was very lucky to have access to MMS technology during my PhD," Kim said. "It addressed the limitations of traditional protein structural analysis techniques with its accuracy and the ability to measure a wide range of protein concentrations and has enabled the precise characterisation of complex food formulations, particularly those involving plant proteins."

A glimpse into the future

Looking ahead, Kim is excited about expanding the application of MMS technology further within her group's research. With an MMS instrument now available in their lab supported by ATA Scientific, the group aims to conduct further experiments, testing samples at various concentrations and protein structures in emulsions. The potential for MMS to revolutionise protein analysis in food science is substantial, and Kim anticipates its widespread adoption in research in the near future.

1. Kim, W., Wang, Y., Ma, M., Ye, Q., Collins, V. I. and Selomulya, C. (2023). Secondary structure characterization of mixed food protein complexes using microfluidic modulation spectroscopy (MMS). Food Bioscience, 53, 102513.



International Conference on Quantum Energy

December 4–6, Melbourne
ICQE 2023 will bring together thought leaders from around the world to explore the role of quantum in addressing some of our global energy challenges and transforming the energy landscape for the future. Presented by CSIRO, the event offers a cross-disciplinary program on the fundamental principles and applied engineering of quantum systems for energy harvesting, conversion, storage and transport.
ICQE 2023 will feature a comprehensive line-up of speakers, an innovative program and several networking opportunities. The Welcome Address will be delivered by Australia's Chief Scientist, Dr Cathy Foley AO PSM, with other esteemed keynote speakers including Professor Gerard Milburn, Dr Alexia Auffèves and Professor Sir Peter Knight set to share their groundbreaking work and latest insights.
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AusBiotech 2023
November 1–3, Brisbane
https://www.ausbiotechnc.org/

AIMS NSW North Coast Scientific Meeting
November 3–5, Port Macquarie
https://www.aims.org.au/events/event/nsw-north-coast-div-conference-2023

ASC 50th Annual Scientific Meeting
November 3–5, Surfers Paradise
https://www.cytology.com.au/annual-scientific-business-meeting

Blood 2023
November 5–8, Melbourne
https://www.blood2023.com/

Nitrogen 2023
November 6–9, Sydney
https://www.nitrogen2023.com/

11th International Conference on Environment Pollution and Prevention
November 10–12, Brisbane
http://www.icepp.org/

AIMS & AACB Tasmanian Branch Scientific Meeting
November 11, Hobart
https://www.aims.org.au/events/category/tas-branch

Australian Academy of Science Symposium 2023
November 13, Canberra
https://www.science.org.au/news-and-events/events/australian-academy-of-science-symposium-2023

Energy Oceania 2023
November 27–29, Melbourne
https://www.energyconferenceaustralia.com/

Global Hydrogen Energy Conference and Exhibition
November 27–29, Melbourne
https://hydrogenconferenceaustralia.com/

Australian Society of Plant Scientists Conference
November 28–December 1, Hobart
https://www.asps.org.au/conferences/asps-2023

Cutting Edge Science Symposium: "Natural hydrogen: A new sustainable geo-source of energy for Australia?"
November 29–December 1, Fremantle
https://events.csiro.au/Events/2023/April/21/Natural-hydrogen-a-new-sustainable-geo-source-of-energy-for-Australia-Public

Sydney Cardiovascular Symposium
November 30–December 1, Sydney
https://www.sydneycvsymposium.org.au/

Acoustics 2023
December 4–8, Sydney
https://acoustics23sydney.org/

Lorne Proteomics 2024
January 31–February 3, Lorne
https://www.lorneproteomics.org/

Lorne Proteins 2024
February 4–8, Lorne
https://www.lorneproteins.org/

Lorne Cancer 2024
February 8–10, Lorne
https://www.lornecancer.org/

Lorne Genome 2024
February 11–13, Lorne
https://www.lornegenome.org/

International Conference on Nanoscience and Nanotechnology
February 13–15, Melbourne
https://iconnference.com/

Lorne Infection & Immunity 2024
February 14–16, Lorne
https://www.lorneinfectionimmunity.org/

Molecular Approaches to Malaria (MAM) 2024 Conference
February 18–22, Lorne
https://mam2024conference.com.au/

Quantum Australia 2024
February 20–22, Sydney
https://sydneyquantum.org/event/quantum-australia-2024/

Pathology Update 2024
March 1–3, Adelaide
https://www.rcpa.edu.au/Events/Pathology-Update

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MDF-DU703VH-PE [1], 729 L

[1](SV -80°C, AT 23°C) for the 5.4 kWh/day energy consumption


Facial Recognition

Various login methods to suit every scenario

Large Control Panel

New & larger control panel with multiple features


EZLatch Handle

POWER CONSUMPTION 5.4 kWh/day

The ergonomic "EZlatch" now coupled with "Electric Lock"

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