Lab+Life SCIENTIST

WINEMAKING
UNDER THE MICROSCOPE

MEASURING
NATURE'S AIR PURIFIER

CALCULATING
TUMOUR MUTATIONAL BURDEN

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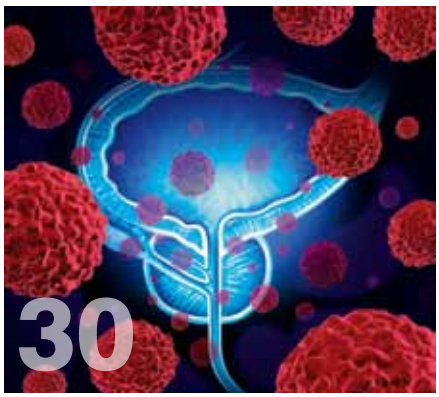

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Weird science

A few weeks ago, it was reported that Russian physicists had succeeded in returning the state of a quantum computer a fraction of a second into the past. Here at *Lab+Life Scientist*, we've managed to wind the clock back even further — back two years, in fact, to when I wrote what I thought would be my final editor's comment for this esteemed publication. Now here we are again, and with my former colleague Mansi Gandhi off to pursue her passion for science elsewhere, the editorship of this magazine has fallen back into my hands. It's good to be back!

So what's been happening in the Australian science industry over the past two years? The big news would have to be the announcement of the Australian Space Agency back in September 2017, with the agency officially established in July 2018 and the government recently pledging $12 million towards Mission Control Centre and Space Discovery Centre, both to be based in Adelaide. And Adelaide is also set to become the home of an industry-linked international joint laboratory, with French scientific research organisation CNRS and maritime technology company Naval Group, leveraging the city's status as capital of the 'defence state'.

But it turns out that bigger isn't always better, with researchers from the University of Chicago recently examining 60 years of publications and finding that smaller teams were far more likely to introduce new ideas to science and technology, while larger teams more often develop and consolidate existing knowledge.

"Big teams are almost always more conservative. The work they produce is like blockbuster sequels; very reactive and low-risk," said study co-author James Evans.

"Whereas the small teams, they do weird stuff — they're reaching further into the past, and it takes longer for others to understand and appreciate the potential of what they are doing."

Working on *Lab+Life Scientist* has certainly allowed me to encounter plenty of 'weird' science over the years — not all of it confined to small teams, I should point out — and I always try to include at least one such story in each issue of the magazine if at all possible. This issue, I was particularly intrigued by our lead article, in which scientists drilled into Antarctic ice cores in order to recover traces of a naturally occurring air purifier!

Elsewhere in the magazine, you can read about how to cure mice of diabetes, a new drug for heart attack damage, microbes on the International Space Station and more. We also have content covering the important issue of quality assurance, which should be relevant to any lab — no matter whether you're conducting routine testing or on the cusp of the next big scientific breakthrough.

I can't wait to see what weird and wonderful discoveries are made by research teams of all sizes throughout the remainder of 2019 and beyond. If you have a story you'd like to share, feel free to send me an email.

Regards,
Lauren Davis
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Lauren Davis

Antarctic mission to measure nature's air purifier

The Christmas of 2018 was very white indeed for Dr David Etheridge, an atmospheric scientist at CSIRO and co-leader of the Law Dome Hydroxyl project.

Along with several other scientists from Australia and the US, Dr Etheridge spent his summer in a temporary lab set up on a remote Antarctic ice sheet, more than 100 km from Australia's Casey research station, where the average temperature hovered around -20°C. The aim of his mission? To investigate a natural 'atmospheric detergent' that cleans the air of greenhouse gases.

Although the majority of greenhouse gas emissions are carbon dioxide, there are more than 40 other gases that contribute to climate change and the depletion of the ozone layer, including methane and hydrochlorofluorocarbons. Luckily for the Earth, many of these gases are removed from the atmosphere by a naturally occurring oxidant called hydroxyl.

Composed of one atom of oxygen and one atom of hydrogen, hydroxyl (OH) is so chemically reactive that it has an average lifetime of around one second before it reacts with something and is consumed. It is this feature that enables it to remove trace gases from the atmosphere, destroying greenhouse gases like methane and industrial chemicals that deplete ozone.

But while scientists have come to understand more about the role of what Dr Etheridge describes as "a natural air purifier", they still find it very difficult to measure — and such measurement is "fundamental to be able to predict the levels of gases that affect climate and the ozone layer into the future", he said.

"Even if you can measure it directly in the atmosphere, one place and one time doesn't give you a meaningful number, 'cos it's so variable," he continued. "So what tends to happen is, people use what we call integrating tracers. These are other gases which are removed by hydroxyl, and by knowing how much of those gases are being removed, you can infer the amount of hydroxyl.

One of the ice drill tents.
©Sharon Labudda/Australian Antarctic Division

"Those gases are longer lived, easier to measure and they give you more of an average concentration. Because hydroxyl's got a lifetime of a second, whereas these other compounds have lifetimes of months or even years."

The researchers were particularly interested in tracer molecules controlled by a chemical reaction with hydroxyl, such as carbon monoxide (CO) that's been tagged by cosmic rays.

"Cosmic rays are constantly bombarding the atmosphere and produce small amounts of the isotope carbon-14 (^{14}C)," Dr Etheridge said. "That gets oxidised to carbon monoxide, and then that carbon monoxide gets removed by hydroxyl. The advantage of that is, we know how it's being produced, so we've got a source; and we know that it's almost entirely removed by hydroxyl. What we don't have is the concentration of that tracer."

^{14}C has been recognised as an ideal tracer of hydroxyl ever since the 1990s, explained Dr Etheridge, when a group of New Zealand scientists produced a paper on it. But while that gives us data on the last few decades, it doesn't cover anything prior.

"The change in the atmosphere as we pushed out industrial gases, greenhouse gases and so on, since the 1800s, we don't have an understanding of how vulnerable hydroxyl was to those extra emissions," Dr Etheridge said. "As it's mopping up and oxidising those gases in the atmosphere, what's happening to it? Is it reducing in concentration, or is it actually able to keep up? That's the main question we're trying to answer."

So how did Dr Etheridge's quest to acquire ^{14}C lead him and his fellow scientists, including co-leader Dr Vas Petrenko from the University of Rochester and field leader Sharon Labudda from the Australian Antarctic Division, to spend up to 12 weeks at Law Dome, Antarctica? According to Dr Etheridge himself, "It's the only place we could do it on the planet."

He explained that Antarctica is a clean, uncontaminated environment — one in which "bubbles of air" can be stored and preserved at depth in polar ice for hundreds of years. And while cosmic rays do produce a small amount of ^{14}C in water molecules (including ice) as well in the atmosphere, the amount is only small, and Dr Etheridge and his team believe they can correct for it.

"If we go to a place where there's a lot of snow falling, any parcel of snow containing air gets buried very quickly, and it gets exported below the surface where the contaminant ^{14}C from cosmic rays would otherwise be produced," Dr Etheridge said. And with the east side of Law Dome receiving around 4 m of snowfall per year, as well as being reasonably accessible through the Australian Antarctic Program, Dr Etheridge said it provided "almost perfect" conditions.

But while these samples containing bubbles of air are shielded while they're under the snow, they become contaminated by further cosmic ray irradiation as soon as they're drawn up, in the form of ice, to the surface. This meant the majority of ice sampled could not be brought back to Australia or the US — "the signal would be obliterated", said Dr Etheridge. The solution? Melt the samples as soon as they come up — in a temporary lab erected on an Antarctic ice sheet, consisting of a series of tents.

"The air that we extracted was from around about half a ton per sample," Dr Etheridge said. "Half a ton of ice was melted to get the air, tens of litres of air, to get the carbon monoxide that we want; the ^{14}C from the carbon monoxide."

Using three drills run by collaborators from the US Ice Drilling Design and Operations (IDDO), the researchers drilled down through 250 m of ice, eventually reaching a depth representing Earth's atmosphere in pre-industrial times. The ice cores were brought to the surface and, within a day, the air was extracted upon melting it in a large tank.

"The air would then pass away from that tank into our science tent, where it would be treated," Dr Etheridge said. "It would be pumped into a canister and some would be measured for the basic

greenhouse gases. Once the air was in the canister, the ^{14}C production would stop."

It was a complicated set-up, to say the least — one which required giant sleds loaded with scientific equipment to be pulled by tractors from Casey to the drilling site. The lab also needed to be snowproofed — the disadvantage of setting up camp in a location where it's always snowing — and the samples themselves could only be handled by scientists wearing cleansuits and gloves.

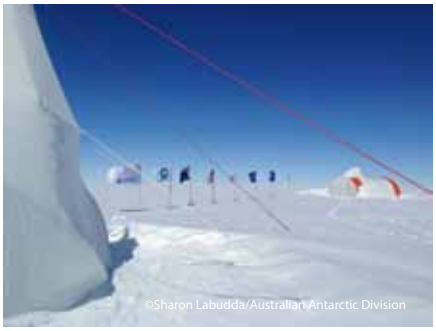
"This is probably the most complex thing we've done in the Australian Antarctic Program for ice core drilling," Dr Etheridge admitted.

"The whole sampling activity had layers and layers of controls around it — the timing, the amount, the cleanliness and so on — and that's because it's a very challenging thing to do at all, but to do it in ice in the Antarctic is just adding another few layers of challenge."

Now the samples have all been safely transported back to the Australian Antarctic Division's headquarters in Hobart, but according to Dr Etheridge, the real analytical work is only just beginning. The air samples need to be contained in quite literally airtight tanks, while a few accompanying ice core samples are kept in freezers below -20°C. The air samples will soon be sent off to the University of Rochester — Dr Etheridge is hopeful that no curious customs officials see fit to open them en route — where scientists will extract the carbon monoxide and oxidise it, to produce carbon dioxide.

"That carbon dioxide is transferred into small tubes called break seals, which will then come back to Australia, to ANSTO in Sydney," Dr Etheridge said. "That CO_2 will be reduced to a small amount of graphite, in the order of 10 µg of carbon."

Finally, these carbon samples will be measured by accelerator mass spectrometry in ANSTO's Centre for Accelerator Science. This atom-counting technique is excruciatingly sensitive, enabling scientists to detect just one atom of ^{14}C amongst 10,000,000,000,000,000 (10^{16}) 'normal' carbon atoms. To put that into perspective, this is about the number of virus particles you would need to line up next to each other to circle the Earth's equator.



"Once we've measured these samples across the past 140 years, and quantified the trend in the tracer that tells us how hydroxyl levels have changed over that period, we can start to provide data for earth systems models that simulate the chemistry and the physics of the atmosphere," Dr Etheridge said.

It's clearly a massive project — one that was four years in the making and, ironically, has not been without its own emissions along the way. But Dr Etheridge firmly believes it's been worth it.

"We are aware of the footprint of the exercise … but we think that this is such a necessary piece of the future of the planet, to understand this, that it's worthwhile," he said.

"It's a huge effort to look at what emissions reductions are required to meet a certain climate future — so let's say a 1.5 or 2° Paris scenario. Emissions are one part of it, but we still need to know about the removal of those gases.

"For example, under a certain emissions scenario, what will be the amount of greenhouse gases or ozone-depleting gases that remain in the atmosphere? What damage will they do to the ozone layer? How much warming will they cause?

"Knowing how hydroxyl varies in the atmosphere is key to answering these questions."

Dr Vas Petrenko with 4″ ice cores in the melter.
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Victoria gets a $496m boost for health and medical research

The Australian Government is investing almost half a billion dollars to deliver world-leading cancer treatment, extra hospital infrastructure, more mental health services and new medical research projects in Victoria.

Prime Minister Scott Morrison said $80 million of the new funding will help create a new national cancer treatment centre at the Peter MacCallum Cancer Centre, providing access to treatments previously only offered overseas. Peter Mac will provide another $25 million towards the initiative.

The Peter Mac Centre of Excellence in Cellular Immunotherapy will provide CAR T-cell therapy, which involves removing a patient's T-cells, re-engineering them in a lab and delivering them back into the body to attack and kill the cancer cells. The funding will allow a new manufacturing industry to be built at Peter Mac, meaning that Australian patients can have their cells manufactured in Australia.

The investment also includes $24.6 million for the Australian Clinical Trials Network's TrialHub program, ensuring Australians with cancer and rare diseases have the chance to participate in clinical trials of new treatments and other interventions as close as possible to their homes.

A collaboration between Monash University and Alfred Health, TrialHub will create partnerships with regional hospitals to expand the reach and participation in clinical trials, allowing patients from all over Victoria access to potentially life-saving treatments. Hospitals in Rosebud, Casey and Bendigo in Victoria will be the first hospitals to partner with TrialHub.

Other funding highlights include the following:

- $40 million for new paediatric emergency departments inside Geelong, Maroondah, Frankston and Casey hospitals.
- $32 million for the new Peninsula Health-Monash University Health Futures Hub, which will be based in Frankston and focus on community health issues including aged care, addiction and mental health.
- $30 million to create a new research facility at St Vincent Hospital's Aikenhead Centre for Medical Discovery, said to be Australia's first hospital-based biomedical engineering research and training hub.
- $25 million to establish a new national Drug Discovery Centre, based at the Walter and Eliza Hall Institute of Medical Research, that will bring life-saving new medicines to patients with the help of advanced robotic gear.
- $16 million to support the mental health of young people by developing eight new Headspace services in Victoria, in addition to the previously announced Wangaratta service.

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Mapping the brain's immune system

German researchers have created an entirely new map of the brain's own immune system in humans and mice, demonstrating in the process that the phagocytes in the brain — the so-called microglia — all have the same core signature but adapt in different ways depending on their function.

Since the immune cells located in the blood cannot reach the brain and spinal cord on account of the blood–brain barrier, the brain needs its own immune defence: the microglia. These phagocytes of the brain develop very early on in the process of embryonic development and later remove invading germs and dead nerve cells. They also contribute to the maturation and lifelong malleability of the brain.

It was previously unclear whether there are subtypes of microglia for the various functions they serve in the healthy and diseased brain. Seeking an answer, a research team led by the Medical Center – University of Freiburg conducted detailed studies on microglia in the brain, both on a mouse model and on human brain tissue removed from patients.

With the help of a new, high-resolution method for conducting single-cell analysis, the researchers were able to demonstrate the features of microglia in great detail. To do so, they used a microscope to study microglia in different brain regions and at different stages of development. They also analysed the RNA levels of these cells using single-cell analysis.

Analysis revealed that microglia all have the same core signatures but adapt differently at different stages of development, in different brain regions and depending on the function they are meant to serve. The study results were published in the journal *Nature*.

"We were able to show that there is only a single type of microglia in the brain that exists in multiple flavours," said project head Professor Dr Marco Prinz, "These immune cells are very versatile all-rounders, not specialists, as has been the textbook opinion up to now."

The discovery is important for our understanding of brain diseases, with dysregulated microglia playing a key role in the development of Alzheimer's, multiple sclerosis (MS) and psychiatric diseases like autism. In healthy brains, microglia form a uniform network around the nerve cells that can change in just a few minutes in the case of disease and form numerous new phagocytes to limit the damage.

"We now possess the first high-resolution immune cell atlas of the human brain. This also enables us to understand how these cells change during course of diseases like MS," Prof Prinz said. "In MS patients, we managed to characterise microglia in a state that is specific for multiple sclerosis. We hope that it will be possible in the future to target microglia subsets in harmful state.

"It is extremely exciting to see how flexible the microglia can be."

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Program uncovers errors in biomedical research

Researchers have created a fact-checking program that is tackling the problem of incorrectly published biomedical research results, whether intentional or otherwise.

'Seek & Blastn' was developed by Professor Jennifer Byrne from the University of Sydney and Dr Cyril Labbé from France's University of Grenoble Alpes. The program verifies the identities of published nucleotide sequence reagents (DNA and RNA constructs used to target genes) by seeking out sequences within papers and running them through a database holding the wealth of knowledge on genes to date.

"Biomedical reagents are like ingredients in cooking — you use them to discover your experimental results," said Prof Byrne. "Doing an experiment with wrong reagents either means that you cook something different from what you thought you were cooking, or what you cook is a failure.

"Here we are dealing with fundamental genetic research, and other researchers are using these failures as building blocks for their own work."

In a cohort of 155 research papers, the new fact-checker combined with manual analysis identified 25% of papers as having sequence errors. Errors uncovered included:

- Sequence reagents that are supposed to target a particular gene, but are in fact predicted to target a different gene from that stated in the publication.
- Sequence reagents that are not supposed to target any gene (as a negative control) but instead are predicted to target a human gene.
- Sequence reagents that are supposed to target a human gene that in fact don't seem to target any gene,.

"That's quite a lot of wrong sequences in a small group of papers and there will be many more out there, unfortunately, given that nucleotide sequence reagents have been described in literally hundreds of thousands of biomedical publications," said Prof Byrne.

Errors represented both identity errors (sequences which were completely incorrect) and typographic errors (sequences that contained the equivalent of spelling mistakes). The researchers propose that sequence identity errors could represent a particular hallmark of research fraud, and could be applied to identify fraudulent papers and manuscripts.

"Our hope is that tools like Seek & Blastn will prospectively deter publications that describe incorrect nucleotide sequence reagents and may flag existing publications so that their conclusions can be re-evaluated," said Prof Byrne.

The program has been described in the journal *PLOS ONE* and has been made freely available to other researchers. It can be accessed at http://scigendetection.imag.fr/TPD52/.

Fungus-based peptide found to kill TB bacteria

Researchers from Lund University and Imperial College London have discovered a potential new pharmaceutical candidate for tuberculosis (TB), finding that the antimicrobial peptide NZX rapidly and effectively kills TB bacteria.

The world's most widespread infectious disease, TB is currently treated by antibiotics — but treatment is a long and complicated process that involves the use of multiple drugs over a period of up to two years. And as the number of antibiotic-resistant TB bacteria increases, so too does the need for an alternative treatment method.

"Despite the long treatment period, last year it was possible to save only 54% of the patients who had antibiotic-resistant bacteria," said Gabriela Godaly, a senior lecturer at Lund University.

Antimicrobial peptides (AMPs) have recently emerged as promising alternatives, as they are produced by all organisms — from plants to mammals — and act as nature's own antibiotics, killing bacteria rapidly. The major advantage of AMPs is that bacteria find it more difficult to build up a resistance to the peptides, as these have more mechanisms than antibiotics to kill bacteria. There are also AMPs that can reduce inflammation and thus prevent damage to tissue during treatment.

Several AMPs have previously been tested against TB bacteria without success, as they have either been toxic to human cells or not sufficiently stable. But when the researchers screened different antimicrobial peptides' ability to prevent the growth of the TB bacteria *Mycobacterium tuberculosis*, they found promising properties in a peptide from a fairly common fungus — the ebony cup (*Pseudoplectania nigrella*).

"When we investigated different peptides, we found one called NZX that is not toxic to our cells, but kills tuberculosis bacteria even at low concentrations," said Godaly. "The peptide could also prevent lung damage during tuberculosis infection."

The study was carried out on human cells in vitro and later verified in animal models using mice. The researchers are now seeking to optimise NZX's properties for use as a future antibiotic, studying how it works against tuberculosis bacteria in combination with current antibiotics (rifampicin, isoniazid, pyrazinamide, ethambutol and streptomycin) in the hope of shortening TB treatment.

"The therapeutic potential of the peptide is further supported in animal models in which NZX significantly reduced the volume of bacteria after only five days of treatment," said Godaly.

"Although it's a big step from mice to humans, we have great hopes for future patient studies, as the verified results in the animal studies were so clear."

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Scientists engineer Zika-resistant mosquitoes

Australian and US scientists have engineered mosquitoes to be resistant to spreading the devastating Zika virus, which caused more than 4000 cases of serious birth defects in 2015 and is still a risk to millions of people. Their work has been published in the *Proceedings of the National Academy of Science (PNAS)*.

Aedes aegypti mosquitoes normally pick up the Zika virus when they feed on the blood of an infected person, and can then spread the virus to the next person they feed on. While the virus itself is not currently present in Australia, *Aedes aegypti* is established in northern Queensland and the Torres Strait.

"People in 86 countries across Africa, the Americas, Asia and the Pacific are at risk of Zika," said CSIRO Senior Research Scientist Dr Prasad Paradkar, a co-author on the new study. "Infection during pregnancy can cause life-threatening complications to a foetus or newborn baby, including birth defects such as microcephaly.

"With increased globalisation and international travel, the virus is capable of making it to Australian shores someday — so we're collaborating with international partners to find innovative ways to reduce the risk both to Australians and to people around the world."

The new study focused on a synthetic anti-Zika gene (anti-ZIKV), which was injected into mosquito embryos along with a red-eye gene to differentiate them from normal mosquitoes. The mosquitoes were engineered by the University of California San Diego and tested in the quarantined insectary at the Australian Animal Health Laboratory in Geelong, CSIRO's national biocontainment facility designed to allow scientific research into the most dangerous infectious agents in the world.

Once the mosquitoes were adults, the researchers found that the anti-Zika gene prevented them from picking up the virus when they fed. They were therefore incapable of spreading the virus to anybody else.

"With further investigation, this mosquito could potentially one day be used to replace populations of wild *Aedes aegypti*, adding to the arsenal of control strategies against this mosquito to halt the virus's spread around the world," Dr Paradkar said.

Zika-resistant mosquitoes were given a red-eye gene to distinguish them. Image courtesy of CSIRO.

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Diagnostic test for Parkinson's nothing to be sniffed at

Researchers from The University of Manchester are developing what they hope will be the first definitive diagnostic test for Parkinson's disease — a neurodegenerative disorder that leads to progressive brain cell death and extensive loss of motor function. Published in the journal *ACS Central Science*, their research came about thanks to Joy Milne, who has the ability to detect Parkinson's through smell.

Scientists already know that Parkinson's can cause excessive production of sebum — a natural waxy, lipid-based bio fluid that moisturises and protects the skin. Milne, an Honorary Lecturer at The University of Manchester, noticed that people with Parkinson's had a distinct and different smell, which changed intensity as the condition progressed. She first noticed this smell in her husband Les, many years before he was clinically diagnosed with Parkinson's.

Researchers at the university's Manchester Institute of Biotechnology (MIB) used mass spectrometry to identify the molecular compounds that give the condition its unique odour. To figure out what makes this smell at a molecular level, the team analysed the volatile components from the sebum found on people who have been diagnosed with Parkinson's. The odour of these components was double-checked by Milne.

The researchers collected sebum samples using gauze to swab the upper backs of more than 60 subjects, both with and without Parkinson's. They then analysed the sample data and found the presence of hippuric acid, eicosane and octadecanal, which indicates the altered levels of neurotransmitters found in Parkinson's patients, along with several other biomarkers for the condition.

By considering the levels of these molecules found in the test samples, the team has generated a model that can now identify and diagnose Parkinson's at all stages of the condition. The study thus opens the door to the development of a non-invasive screening test for Parkinson's, potentially leading to earlier detection as well as monitoring the effect of therapy in current patients.

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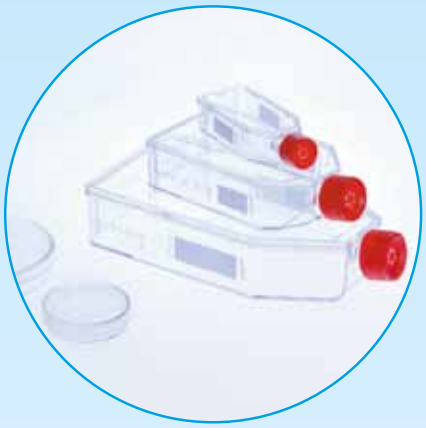

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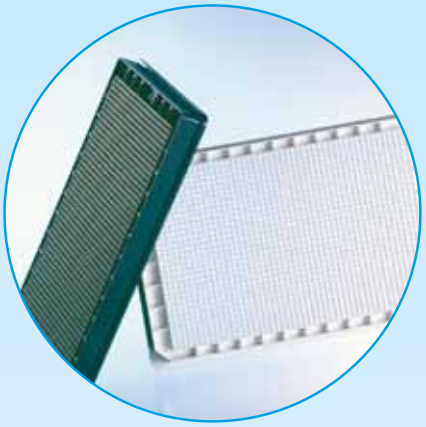

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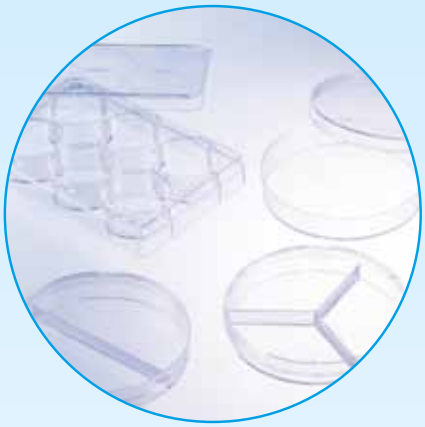

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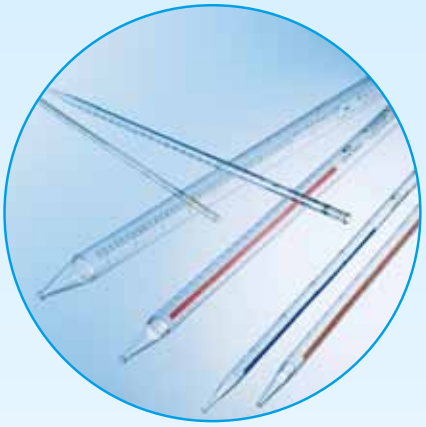
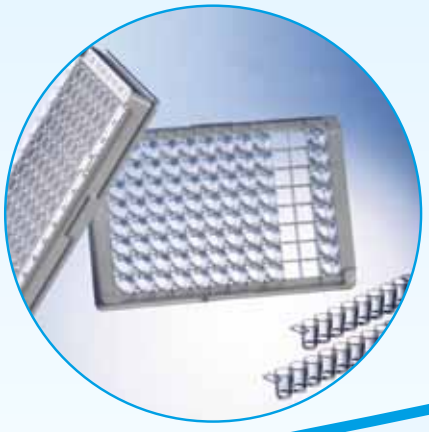


Upscaled Cell Culture

Immunology



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Scientists from UK drug discovery company Domainex, working in partnership with Imperial College London, have found a potential new drug for treating the damage caused by a heart attack by targeting the way the heart reacts to stress.

New drug developed to treat heart attack damage

A heart attack happens when a blood clot blocks one of the main coronary arteries, the blood vessels supplying the heart muscle. The heart is starved of oxygen and nutrients and the muscle produces stress signals that ultimately cause heart cells to die. This means that the heart can't pump effectively and this can lead to heart failure — a debilitating condition that makes everyday tasks like climbing stairs, or even getting dressed, exhausting.

Due in large part to research funded by the British Heart Foundation (BHF), more people than ever before are surviving heart attacks after receiving treatments like stents and clot-busting drugs, but this means that the number of people living with heart failure has risen considerably. There are estimated to be over 900,000 people living with heart failure in the UK.

Now, BHF Professor Michael Schneider and his team at Imperial College London are working to develop drugs that could be given in the first few hours following a heart attack to minimise heart muscle death caused by the stress signals. These stress signals actually increase dramatically when the blood supply is restored so, although it is vital to resupply the heart with oxygen and nutrients by reopening the blocked coronary artery, additional treatments to counteract any 'reperfusion injury' have been sought for decades.

The researchers discovered that a protein called MAP4K4 plays a central role in how heart muscle cells die off as a response to the stress of a heart attack, finding that MAP4K4 is activated in mice after a heart attack, as well as in heart cells and heart tissue subjected to stress chemicals in the laboratory. They found that if you raise the levels of MAP4K4, heart cells are made more sensitive to stress signals. If you block MAP4K4, the cells are protected — and that is what the team's new drug is designed to do.

To mimic what might happen in a clinical setting, the laboratory mice were given the drug one hour after the blood flow to their hearts was restored. This showed that the drug could reduce heart damage in mice by around 60%. The researchers also used stem cells to grow human heart tissue and mimic a 'heart attack in a dish', and were able to block the signals that lead to cell death and heart damage.

"There are no existing therapies that directly address the problem of muscle cell death and this would be a revolution in the treatment of heart attack," said Prof Schneider. "One reason why many heart drugs have failed in clinical trials may be that they have not been tested in human cells before the clinic. Using both human cells and animals allows us to be more confident about the molecules we take forward."

It is hoped that the new treatment would be developed into an injection that could be given as someone was being prepared to receive balloon angioplasty to open up the blocked coronary artery that caused their heart attack. The treatment is also possibly important for towns and countries where there is limited access to rapid angioplasty.

The BHF-funded research has been published in the journal *Cell Stem Cell*, with the potential new drugs developed by Domainex. The next steps including rigorous safety testing and a clinical trial, which could start as early as 2021–22.

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Dr Cameron Chai

Winemaking under the electron microscope

While most of us enjoy a glass of wine or three, we are blissfully unaware of the science of winemaking or oenology. While winemakers or vintners themselves may not be scientists as we know them, there is no doubt they have an in-depth understanding of their craft, and a whole lot of patience.

Above: *Brettanomyces* yeast cells that are responsible for the 'brett' character of wines.

According to data released by the Australian Bureau of Statistics, our wine consumption has been relatively consistent over the last 15 years. While wine is our second favourite alcoholic beverage behind beer (based on pure alcohol volume), wine accounts for 38.3% of the alcohol consumed, trailing beer by less than 1%. Beer consumption, however, has been in steady decline since the heady days of mid-70s. In fact, the steady decline in beer consumption has resulted in Australia's lowest alcohol consumption in 50 years.

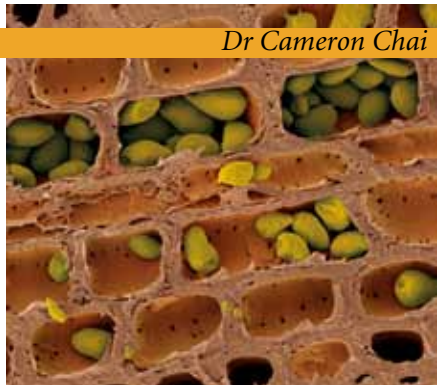
The growing of grapes specifically for winemaking or viniculture is obviously a key part of the winemaking process. While winemakers no doubt have a good understanding of what makes their crops grow the best, it is unlikely they have ever used a scanning electron microscope (SEM) to look at their valuable produce.

Consequently, TESCAN, a leading manufacturer of SEMs based in the Czech Republic, and the National Wine Centre collaborated and undertook such a study looking at grape vines and winemaking at high magnifications. TESCAN is located in the city of Brno, in the region often referred to as the cradle of electron microscopy in Europe. Brno is also the capital of Moravia, responsible for 95% of the national wine production. The samples used in this study were provided by the Department of Viticulture and Viniculture at Mendel University, also located in Brno.

The resulting electron micrographs provide a highly detailed view of structures relating to winemaking, revealing features that are largely invisible to winemakers and wine lovers alike. The images were blown up and put on display last year in a public exhibition in the cellars of Valtice Castle, home of the National Wine Centre and part of a UNESCO World Heritage Site.

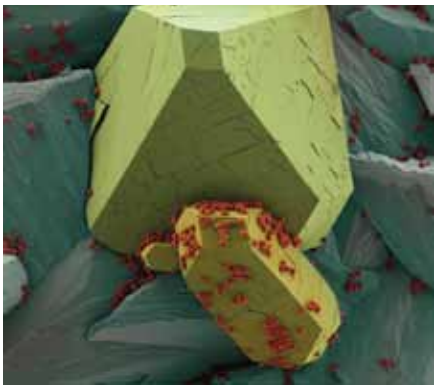
Pavel Krška, Director of the National Wine Centre, commented, "As far as we know, this exhibition is the first of its type and the feedback from visitors has been extremely positive. They are in awe of the images and visitors appreciate the fact that they are being given access to highly scientific content presented in such a way that it appeals to wine aficionados and the broader community."

Images by TESCAN.

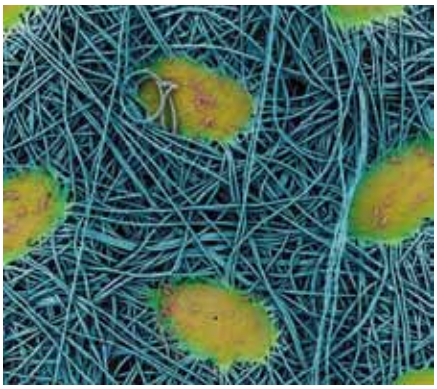


Starch grains (proteins) deposited in the vascular tissues.

Detail of a stoma — a respiration pore on the bottom side of a grape leaf. Used for nutrient exchange (CO_2 and O_2 in particular) between the plant and surroundings.



Potassium bitartrate of potassium hydrogen tartrate crystal with yeast cells. Its crystallisation produces turbidity in the form of fine white or yellowish sediment. While it does not affect the taste or smell of the wine, it has a negative effect on the aesthetics of the wine.



Wine clarification filter used to purify wine before bottling with pores in the range 0.45 to 1.2 μm. These membrane filters are used to remove certain yeast cells and bacteria.

UHPLC series

Shimadzu Corporation announces the Nexera Ultra High-Performance Liquid Chromatograph series, incorporating artificial intelligence as analytical intelligence, allowing systems to detect and resolve issues automatically. The Nexera series makes laboratory management simple by integrating IoT and device networking, enabling users to easily review instrument status, optimise resource allocation and achieve high throughput.

The Nexera UHPLC series maximises uptime with fully unattended workflows from start-up to shutdown, incorporating auto-purge, equilibration, baseline checks and system suitability in advance. In addition, FlowPilot ramps up the flow rate gradually, reducing the possibility of damage to columns. The product also has auto-diagnostics and auto-recovery capabilities that allow it to monitor pressure fluctuations to check for anomalies.

With remote mobile phase monitoring and integrated consumables management, the system maximises uptime and efficiency. The series allows analysts to confirm parameters and monitor chromatograms in real time directly from a web browser on their smart device.

The product further increases efficiency by automating workflows and maximising throughput analysis. The SIL-40 autosampler can process the entire injection cycle time in as little as 7 s, and continuous analysis can be carried out on up to 44 MTPs (using three plate changers).

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

Electronic pipettes

Designed for natural hand movement and professional workflow, Picus and Picus NxT Electronic Pipettes combine safety, ergonomics and design in one product.

Up to 40% of lab professionals suffer from injuries related to pipette use. On an average every laboratory technician has to perform up to 10,000 pipetting procedures per day. Using the wrong equipment during sample processing for cell culturing procedures not only affect the results but also leads to repetitive strain injury (RSI).

As each individual user knows what's best for their everyday work, Sartorius offers pipettes that best match the needs of every requirement. Users can thus choose the pipette that's ergonomically right for them and see how it improves their cell culture results.

Sartorius Australia Pty Ltd
www.sartorius.com

Wettability and adhesion measurement

The Attension Theta Flex, from Biolin Scientific, is an all-in-one fully automated contact angle meter designed to support high-end imaging for even the most demanding industrial and research applications.

The modular design and all-inclusive software enable fast and simple operation while sophisticated analysis algorithms allow for repeatable results. Surface properties and interactions can be studied quickly and easily to understand the performance of a product or process. Measurements include static and dynamic contact angle, 3D surface roughness, surface free energy, surface and interfacial tension and interfacial rheology.

Theta Flex can be combined with a wide range of modules and accessories, including the 3D Topography module. By measuring both contact angle and surface roughness of the sample in a single measurement, users can quickly distinguish the effect of roughness on contact angle and surface free energy.

The high-pressure chamber module is designed for wettability research within enhanced oil recovery and enables measurements at pressures up to 400 bars and temperatures up to 200°C. The Pulsating Drop Module oscillates drop volume for interfacial rheology studies while the Picoliter Dispenser delivers picolitre-sized droplets for small sample areas and inkjet applications. For advancing and receding contact angles, a tilting cradle tilts the entire Theta Flex to provide fully automatic dynamic contact angle measurements commonly used as an indicator of surface homogeneity.

ATA Scientific Pty Ltd
www.atascientific.com.au

Spheroid-forming human hepatocytes

Lonza has expanded its hepatocytes portfolio characterisation with the addition of Verified for Spheroids Human Hepatocytes, which are pre-screened for their ability to promote rapid spheroid formation in cell culture. Researchers working in toxicology, disease modelling and DMPK studies will find the hepatocytes suitable for their spheroid and other 3D culture platforms.

Physiologically relevant in vitro liver model systems play a crucial role in the success of toxicology, disease modelling and DMPK studies. Conventional 2D hepatocyte cultures offer good short-term models, but they tend to rapidly lose typical hepatocyte functionality, which makes them unsuitable for longer-term studies.

To address this challenge, self-assembling liver spheroids generated from primary human hepatocytes (PHH) are increasingly employed. These spheroids exhibit in vivo-like cell organisation, improve the predictability of known clinical liver toxicants and preserve the viability and functionality of the hepatocytes. However, not all currently available hepatocyte donor batches are capable of forming spheroids in culture.

Lonza's pre-screening process ensures that its hepatocytes are suitable for the user's needs, with the company having recently analysed and optimised the formation, culture and performance of PHH in different spheroid culture systems. The study also compared metabolic function and viability of the spheroids over 28 days in culture. Primary human hepatocyte spheroids were rapidly generated that exhibited the ability to support liver metabolic function during long-term exposure and repeated dosing toxicology studies.

Lonza Australia Pty Ltd
www.lonza.com

The challenge of studying climate change

Nearly 30 years of international cooperation

Understanding the long-term changes in the atmospheric composition, as well as the origin of pollutants, is critical to anticipate and mitigate changes in the Earth's climate.

In 1992 the international community created the Global Climate Observing System (GCOS), sponsored by the World Meteorological Organization (WMO). This program has driven the creation of international expertise networks and analytical laboratories to monitor greenhouse gas emissions and air pollutants such as nitrogen oxides (NOx) affecting the ozone layer.

In addition to the measurement of variations of gas or pollutant concentrations in the air we breathe, understanding the sources and causes of these variations is critical to act and mitigate our impact on the environment. This is where stable isotopes can play an important role.

Stable isotopes to identify anthropogenic emissions

Stable isotopes are elements that are chemically identical but different in mass, owing to a difference in the number of neutrons. They are naturally occurring and do not decay over time, and their abundance differs with varying conditions.

The unique properties of stable isotopes allow them to be used in a wide variety of applications, such as reconstructing past climate changes or identifying food fraud. They can also be used as tracers which are deliberately added to systems to be studied, such as those used for understanding drug metabolism.

The isotopic ratios of gases, measured as a 'delta value' against a standard, are natural barcodes to indicate geographical origin and compound formation. By measuring isotopic ratios of carbon, hydrogen, oxygen, nitrogen and sulfur, it becomes possible to understand the origin of gases and pollutants in the atmosphere with precision.

As an example, by measuring the ratio of carbon-12 and carbon-13 in atmospheric carbon

dioxide (CO_2), scientists can identify its origin. In particular, carbon released from burning fossil fuels has a lower delta value (-25‰ to -20‰) than the atmospheric, volcanic or oceanic sources (>-10‰). Similarly, anthropogenic methane or NOx emissions from fossil fuel combustion exhibit different delta values compared to natural emissions.

However, measuring changes in the composition of the atmosphere and its causes relies on the establishment of standards to set 'zeros', to ensure repeatability and ability to compare measurements around the globe.

Synthetic air vs natural air

A simple way to produce calibration standards could be to manufacture synthetic air, starting with a mixture of nitrogen and oxygen and adding small quantities of the gases monitored. However, despite multiple attempts by laboratories and industrial gas companies worldwide, these mixtures can be unstable due to multiple interactions between gases when mixed together. Moreover, depending on the geographical source of gases, the isotopic ratios are not aligned with the international standards and cannot be used to properly calibrate instruments such as a cavity ring-down spectrometer (CRDS).

The WMO has therefore defined a natural air standard based on collected 'pure' air samples. These samples are references for worldwide laboratories but expensive and relatively difficult to obtain due to limited quantities. As a result, many laboratories define their own standards locally but cannot adequately calibrate their instruments and are not able to compare results with other locations.

To aid in this essential research and increase accessibility to this standard, Air Liquide has developed a range of stable isotope ratio gases for atmospheric analysis. The company's natural air is collected at an altitude above 2300 m, filled in situ, analysed and calibrated in its laboratories to reach the specifications of the natural air reference gas defined by the WMO.

Air Liquide also provides stable isotope pure gases and mixtures for other environment control applications (eg, landfill contamination, groundwater nitrate traceability), oil and gas exploration, food fraud detection and medical applications.

Air Liquide Australia Limited
www.airliquide.com.au

Laser-free confocal fluorescence microscope

Aurox unity is an all-in-one, compact, laser-free confocal microscope system designed for high-resolution confocal images comparable to those of significantly larger confocal microscopy systems. Designed for installation and use where samples are generated, it removes the immediate need for travel to a core microscopy facility.

No laser means low maintenance, low cost of ownership and no laser safety restrictions, making the product fast, easy to use and accessible to all. It uses a multispectral LED light source based on the CoolLED pE-300Ultra. The result is a high-performance confocal microscope that accommodates low photo-toxicity and low photo-bleaching.

The unit comes complete with a large-format tablet computer, which communicates over a secure private wireless connection. Visionary software presents all experiment set-up and device controls in one colour-coded workflow under a single graphical user interface window. It enables z-stack, timelapse and multi-channel imaging; confocal, wide-field and bright-field modes; high/medium sectioning and high signal confocal modes; OME-TIFF format; one-click image export; and more.

ATA Scientific is the local distributor for the Aurox unity laser-free confocal microscope system. For more than 28 years ATA Scientific has provided support to customers throughout Australia and New Zealand. The company offers ongoing applications assistance and a range of technical services, including operator training and preventive maintenance.

ATA Scientific Pty Ltd
www.atascientific.com.au

Syndromic testing instrument

In the near-patient clinical lab, acute conditions like respiratory disease require immediate intervention. Correct identification of the causative pathogen is key to selecting the right treatment, but many respiratory pathogens cause similar symptoms. This makes it difficult for scientists to know which one they're up against.

Multiplex syndromic testing rapidly and simultaneously surveys a large number of pathogens, giving users the answers they need when they need them.

Using direct swab or liquid transfer, the QIAstat-Dx provides results for 20+ respiratory or gastrointestinal pathogens in about 1 h, with less than 1 min of hands-on time. The TGA registered panels are available now in Australia.

QIAGEN Pty Ltd
www.qiagen.com

Jellyfish collagen 3D scaffolds

Jellagen introduces its Jellyfish Collagen 3D Scaffolds, enabling researchers to culture their cells in a way that mimics 3D living organisms. Users also benefit from an innovative disease-free alternative to mammalian reagents; batch-to-batch consistency; compatible with all existing cell culture protocols; sequence homology to collagen type I, II and V; and uniform pore size.

Jellagen collagen is a native collagen structure derived from jellyfish, an evolutionary ancient chemical lineage and the root of all collagens. Due to the simple nature of jellyfish, Jellagen is a pure and native form of collagen offering beneficial characteristics. Non-cytotoxic and purified, it is said to be cleaner in terms of non-specific miRNA content compared to mammalian collagen. With an ISO13485 certified manufacturing process, it is designed to offer improved research productivity, allowing security of product consistency and reproducible results.

The jellyfish collagen is available as Research Grade Collagen and as 96-well jellyfish collagen-coated plates. Research Grade Collagen is provided as self-coating collagen solution which can be used for all existing collagen protocols and applications. It has also been tested in 2D culture with mammalian and human primary cells to verify it is applicable for routine laboratory cell culture research. Jellyfish collagen offers Type I 'Like' and Type II 'Like' scaffold properties.

BioNovus Life Sciences
www.bionovuslifesciences.com.au

Tumour mutational burden

and the importance of panel size

When it comes to cancer treatment, tumour mutational burden has become increasingly utilised as a biomarker for immunotherapy response prediction — and in order to capture an accurate measurement of TMB across different cancer types and tumour loads, panel size matters.

Immunotherapy has quickly become the new pillar in cancer care, showing incredible promise for patients with various forms of cancers such as melanoma, non-small cell lung cancer (NSCLC), bladder cancer and kidney cancer among others. However, only a subset of patients benefit from these immunotherapies, and the use of predictive biomarkers is essential in stratifying patients into responders versus non-responders. The overall load of somatic mutations in the tumour, or tumour mutational burden (TMB), has become increasingly utilised as a biomarker for response prediction.

Numerous clinical studies have demonstrated that higher mutational burden correlates to improved survival benefits in patients receiving checkpoint inhibitor therapies for cancers such as melanoma, colon and NSCLC. Recent data from clinical trials such as CheckMate 227 have demonstrated that in NSCLC, higher TMB is associated with improved clinical outcomes, and there are additional trials currently underway using TMB as a biomarker.

Initial studies used whole exome sequencing (WES) as the gold standard for measuring TMB; however, cost, computational complexity and time for WES make targeted panel sequencing more attractive for routine use at present. While a variety of such gene panels of differing sizes are offered commercially, there has been very little reporting on the ideal sizes or methods of calculating TMB — until now.

Dr Albrecht Stenzinger, a pathologist at Heidelberg University Hospital, and his colleagues recently performed in-silico analysis (using combinatorial calculations and extensive simulations) of TCGA data of 8371 tumours across 25 different cancer types, including lung, melanoma, pancreatic, breast, head and neck among others. The researchers specifically investigated the influence of gene panel size on the precision of TMB measurement by considering certain core parameters, including the confidence intervals of TMB reporting, use of all mutations versus only missense mutations, and sensitivity and specificity for detection of hypermutated tumours. Their findings were recently published in the *International Journal of Cancer*.

The study assessed the performance parameters of two Illumina panels — TruSight Tumor 170 (TST170) and TruSight Oncology 500 (TSO500), a forthcoming panel, in the context of the in-silico analysis. The research highlights the following:

- Smaller panels result in imprecise measurement of TMB, especially for tumours with low TMB values. The data suggests that TMB estimation using small gene panels can be highly imprecise and thus clinically suboptimal for patient stratification and response prediction.
- TMB cut-off to identify hypermutated tumours is dependent on panel size, as well as on specific histology. Larger gene panels were associated with reasonable cutoff values that help identify true signals from background noise in routine diagnostics.
- Panels between 1.5 and 3 Mb were recommended to balance benefits with cost. It was also recommended that both missense and nonsense mutations are used to calculate TMB.
- TSO500 with a panel size of 1.94 Mb was shown to have good performance and is preferable for TMB measurement over TST170.

"Studies such as this highlight the importance of panel size to the accurate measurement of TMB across different cancer types and tumour loads," said Dr Phil Febbo, Chief Medical Officer at Illumina. "To the best of my knowledge, this is the first publication to use large-scale computational analysis to evaluate how size of the gene panel, and the type of mutations included in the calculations, impacts measurement of TMB.

"Of course, algorithms for mutation calling and filters to remove artefacts and germline variants are also components of accurate TMB, but this paper will contribute significantly to ongoing efforts working to standardise TMB as a biomarker."

Illumina Australia Pty Ltd
www.illumina.com

Access PD-L1

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abcam

Eliminating superbugs on the International Space Station

An antimicrobial coating made of precious metals has reduced growth of bacteria on contamination-prone surfaces inside the International Space Station (ISS), where extreme conditions can foster antibiotic-resistant superbugs.

When astronauts leave Earth, bacteria stay with them, remaining with them through spaceflight and on the unearthly conditions of the ISS. This creates a perfect storm of weakened immune system and strengthened bacteria, which can put crew at risk. Furthermore, these effects — and the risk of infection — grow with mission duration, and the genes responsible for these new traits can be readily shared among different species of bacteria.

"Spaceflight can turn harmless bacteria into potential pathogens," said Professor Elisabeth Grohmann of Beuth University of Applied Sciences Berlin. "Just as stress hormones leave astronauts vulnerable to infection, the bacteria they carry become hardier — developing thick protective coatings and resistance to antibiotics — and more vigorous, multiplying and metabolising faster."

To address this problem, Prof Grohmann and her colleagues tested a silver- and ruthenium-based antimicrobial coating, known as AGXX, on a contamination-prone surface aboard the ISS: the toilet door. Silver on its own has been used since prehistory to prevent microbial growth, and today it is found in everything from socks to swimming pools — which is, ironically, perhaps why resistant bacteria have begun to emerge.

"AGXX contains both silver and ruthenium, conditioned by a vitamin derivative, and it kills all kinds of bacteria as well as certain fungi, yeasts and viruses," Prof Grohmann said. "The effects are similar to bleach — except the coating is self-regenerating so it never gets used up."

Published in the journal ***Frontiers in Microbiology***, the study showed that the AGXX coating proved to be highly effective, dramatically reducing the number of bacteria on contamination-prone surfaces. Prof Grohmann said, "After six months' exposure on the ISS, no bacteria were recovered from AGXX-coated surfaces."

Even at 12 and 19 months, a total of just 12 bacteria was recovered — a reduction of 80% compared to bare steel. A regular silver coating tested for comparison had only a slight antimicrobial effect, reducing the number of bacteria by 30% versus steel.

"With prolonged exposure time a few bacteria escaped the antimicrobial action," Prof Grohmann said. "The antimicrobial test materials are static surfaces, where dead cells, dust particles and cell debris can accumulate over time and interfere with the direct contact between the antimicrobial surface and the bacteria.

"Most importantly, no serious human pathogens were found on any surface. Thus, the infection risk for the ISS crew currently is low."

Nevertheless, all bacterial isolates were able to form immunity-evading slimy coatings, and most were resistant to at least three antibiotics. They were also able to share the genes responsible.

"Immunosuppression, bacterial virulence and therefore infection risk increase with duration of spaceflight," Prof Grohmann said. "We must continue to develop new approaches to combat bacterial infections if we are to attempt longer missions to Mars and beyond."

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Maggie Vantangoli Policelli, PhD, Field Applications Scientist

Keep your HCA under control

Having sufficient replicates is not enough to ensure reliable results. An important but commonly overlooked aspect of image-based assay design for high content analysis (HCA) is the use of appropriate controls.

It is critical to use the correct controls for every run, plate and experiment with image-based data. For image-based assays, there are two types of control — treatment controls and labelling controls.

Treatment controls

The use of treatment controls (also known as experimental controls) allows you to correctly assess the effects of your compound of interest. For assessing compounds, you should always include three types of controls:

- **Positive control:** fluorescently labelled cells in the presence of a treatment with a known effect. This allows for assessment of changes with the biology, including problems with the cells you are using. This also allows you to evaluate your staining reagents, and to adjust your exposure settings appropriately. The use of positive controls is often overlooked, but it is extremely important for ensuring correct biological responses. When cells do not respond to the positive, it can indicate problems with the biology, plate or sample preparation.
- **Negative control:** fluorescently labelled cells without any treatment. The role of the negative control is to inform the user about the native state of the cells without treatment, and to demonstrate that effects seen in experimental wells are due to treatment with your compound of interest. It can also be compared to the vehicle control.
- **Vehicle control:** fluorescently labelled cells with only the substance in which your compounds are dissolved. This allows you to assess whether the changes you are seeing are due to the vehicle (for example, DMSO or ethanol) or the compound of interest. The vehicle control demonstrates that the vehicle (what your compound is dissolved in) does not elicit the response.

Labelling controls

In addition to experimental controls, you should also include labelling controls. Labelling controls include the following:

- **Secondary-only control:** cells with secondary antibodies only. The secondary-only control is used to ensure that any secondary antibodies are not exhibiting non-specific binding in the assay. This non-specific binding can often be attributed to insufficient blocking during the antibody staining protocol.
- **Autofluorescence control:** unlabelled cells. The autofluorescence control is used to detect background fluorescence of the sample. This could be autofluorescence of the cells or the media, and helps you determine what is background and what is true signal.

By taking the time up front to set up the correct controls, you can get better answers from your HCA experiments, faster and with greater confidence.

GE Healthcare Australia Pty Ltd
www.gehealthcare.com

Quick-connect air valves

RAVEqc quick-connect air valves from Restek are a tool-free alternative to bellows/diaphragm valves, designed to reduce the time and variability associated with connecting air canisters to other devices.

Standard bellows/diaphragm valves rely on compression fittings to connect air cans to flow controllers, autosamplers, cleaners and other equipment commonly used to collect and analyse air samples. Compression fittings also require time and skill to ensure the connections are not overtightened, cross threaded or leaking, which can cause damage, reduce valve lifetime and result in sample loss.

RAVEqc quick-connect air valves eliminate that risk by providing a means of making the connection and opening the valve in one consistent process that means anyone can successfully use them. Whether users need to replace their existing bellows/diaphragm valves or want the extra security of using two valves in tandem to better protect their samples, the quick-connect air valves are an easy-to-use option that make air sampling and analysis easy.

Leco Australia Pty Ltd
www.leco.com.au

Ductless fume cabinet

The Cruma ductless fume cabinet is useful for removing gaseous polluting agents in a simple and flexible way.

All four fume cabinet walls are transparent and are built using toughened 6 mm thick acrylic glass, making it suitable for all kinds of environments, including education and research laboratories. The purpose-built base (trolley) is made of 1.2 mm galvanised coated steel with anti-acid polymer resin powder to prevent potential corrosion.

The hood features a large LCD display from where the unit is controlled and an ABEK filter that lasts for up to 60 h. The cabinet has been ISO 9001 certified.

Westlab Supplies
www.westlab.com.au

Go beyond traditional microscopy:

use the latest label free techniques for live cell imaging

Live Cell Imaging in the microscopy world is constantly evolving as researchers search for techniques to elucidate further mysteries of the human body. Although conventional techniques can open up important new insights into cell structure and behaviour, it is crucial when performing such experiments that cell viability is at the forefront of any measurement. Important challenges must be overcome in order to ensure that the physiological and biological processes that are under investigation are not altered in any way. The lack of contrast and presence of imaging artefacts in some methods make it difficult to distinguish different cell types, while the high level of illumination needed to excite fluorophores alter normal cell functions. This limits the scope, duration and integrity of an experiment as cells suffer from phototoxic shock. As such, it is essential to minimise light exposure, to maintain cells in a healthy state during imaging. Here, we aim to give a brief overview of the newest approaches to live cell imaging that provide solutions to these and other challenges.

Ptychographic Quantitative phase imaging (QPI) for greater clarity, contrast and precision

The LiveCyte™ imaging & cell analysis system from Phasefocus employs a different modality in imaging called Ptychography. High contrast cell images are generated under low levels of light intensity, allowing individual cells to be identified and tracked for prolonged periods without the need for perturbing labels. This ability to image under a more natural environment supports the use of sensitive cell types and enables viable cells to be recovered for subsequent experimentation or downstream analysis. The ability to segment and follow individual cells is paramount for accurate quantification of cell behaviour and differentiates LiveCyte from other commercially available live cell imaging systems. Furthermore, the technology employed in LiveCyte delivers a continuous field of view with no loss of resolution permitting even highly motile cells to be tracked during time-lapse imaging, ensuring no cells are "lost". Each experiment automatically yields a plethora of metrics, providing information on phenotypic parameters such as cell thickness, volume, dry mass in addition to kinetic behaviour characterised by factors including cell speed, displacement and meandering index. Livecyte represents a rapid and cost-effective means of gaining deeper insights into biological processes.

Laser-free benchtop confocal microscope with low maintenance and low cost of ownership

Aurox Ltd, Oxford, UK, have added a new system to their already successful "Bolt On" Clarity range of confocal microscopes with the recent launch of the Unity laser-free confocal microscope. This compact benchtop system removes the immediate need for travel to a core microscopy facility. Utilising a patented spinning disk design with a novel optical arrangement the Unity is able to generate high resolution confocal images comparable to those of significantly larger and more expensive systems — all without using a laser meaning low photo-toxicity and low photo-bleaching.

Affordable Real – Time Cell History Recorder

NanoEnTek, Seoul, Korea, have developed the JuLI Stage, an individualised Real – Time Cell History Recorder. It is a fully automated, multi-channel, multi-well and multi-position cell analysis system that can be used inside an incubator. Time lapse images record the whole history of a cell from beginning to end. The image stitching functionality is ideal for analysing tissue sections or stem cell colonies in the entire well from individual high resolution images. JuLI Stage software is easy to use and can be remotely controlled allowing any user to monitor cell cultures and analyse experimental data from outside the laboratory.

Choosing the right microscope for your experiment

With a flood of light microscope techniques now available for studying dynamic processes in living cells, it can be overwhelming to decide which techniques or equipment to try. ATA Scientific provides a range of unique technologies designed to accommodate the needs of even the most challenging of applications and budgets. Contact us for a demonstration or for a quick guide on choosing the right microscope for your needs.

ATA Scientific Pty Ltd
www.atascientific.com.au

Laboratory refrigerator with electronic controller

The 583-litre LIEBHERR Laboratory Refrigerator with electronic controller (LKv 5710) is suitable for laboratories requiring a large-volume refrigerator for the safe and secure storage of valuable samples and reagents.

Samples and reagents can be optimally stored between 3°C and 16°C, and temperature can be set to 1/10°C accuracy with the electronic controller for precise temperature control. The dynamic (forced-air) cooling system working with the double ventilation and routing of the air flow promotes a consistent internal temperature, and the in-built safety thermostat prevents the temperature dropping below 2°C to protect contents.

The laboratory refrigerator is fitted with five adjustable shelves giving end users flexibility on how they manage their samples. Visual and audible alarms alert users of temperature breaches, power failure and when the door is left open for more than 1 min.

The in-built memory function of the electronic controller records min/max temperature as well as the last three alarm events, storing this data for 41 days. For independent temperature monitoring, a 10 mm access port allows independent temperature sensors to be connected without compromising temperature control.

The laboratory refrigerator is equipped with a keypad lock to prevent temperature and alarm settings changes without a passcode and fitted with a physical lock to protect against unauthorised access. For extra security, temperature and alarm data can be transferred to remote monitoring systems via the RS485 serial port and/or alarms can be forwarded using the volt-free alarm contact.

Andi-Co Australia
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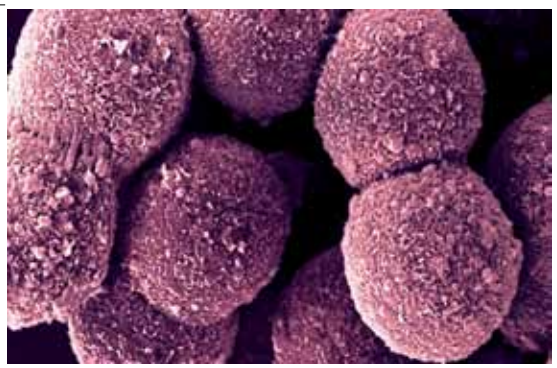


Pooled donor suspension hepatocytes

Lonza has launched DonorPlex Hepatocytes, a line of high-quality cryopreserved pooled donor suspension hepatocytes. Researchers within DMPK and ADME laboratories can now benefit from this robust product offering for studying the hepatic metabolism of drugs.

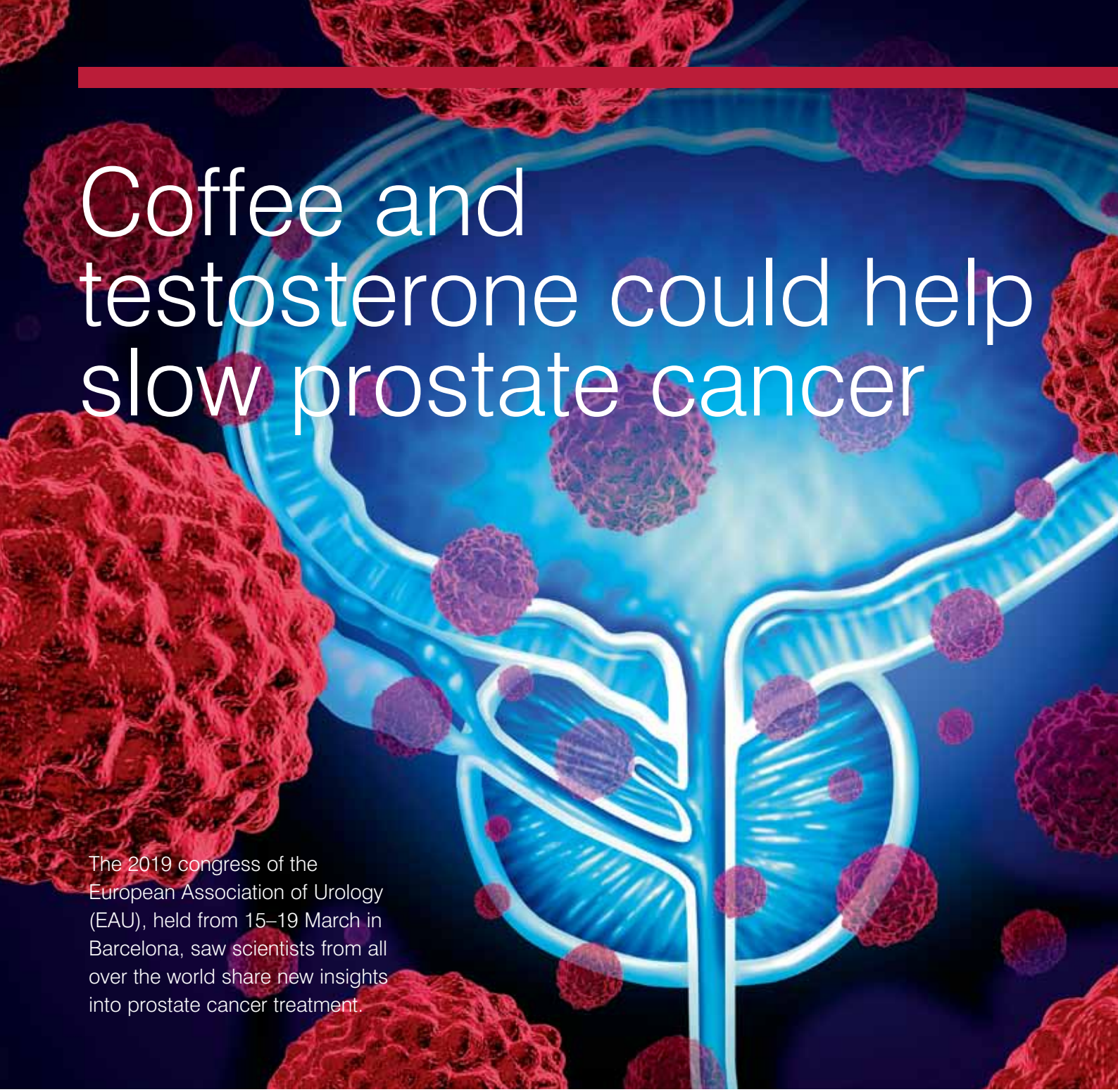
Understanding hepatic drug metabolism is necessary to meet the strict safety-testing requirements for market approval of new products. Researchers typically need to use primary cryopreserved hepatocytes from a large number of donors to obtain a statistically significant result. However, pooled donor hepatocytes currently available commonly suffer from increased lot-to-lot variability, while not being able to meet more specialised application needs.

Lonza's manufacturing process is designed to ensure that the DonorPlex Hepatocytes exhibit improved phenotype reproducibility. Furthermore, a proprietary algorithm that predicts yield, viability and functional phenotype prior to manufacture ensures individual customer specifications are met, meaning the company can provide users with a variety of hepatocyte configurations and sizes that either represent the average population or meet specific metabolism testing and cytochrome P450 (CYP) activity needs.

The company offers a large, comprehensive inventory of cryopreserved single donor suspension hepatocytes, which include a range of 10-, 20- and 50-donor gender-specific and mixed-gender lots.

Lonza Australia Pty Ltd
www.lonza.com

Coffee and testosterone could help slow prostate cancer



The 2019 congress of the European Association of Urology (EAU), held from 15–19 March in Barcelona, saw scientists from all over the world share new insights into prostate cancer treatment.

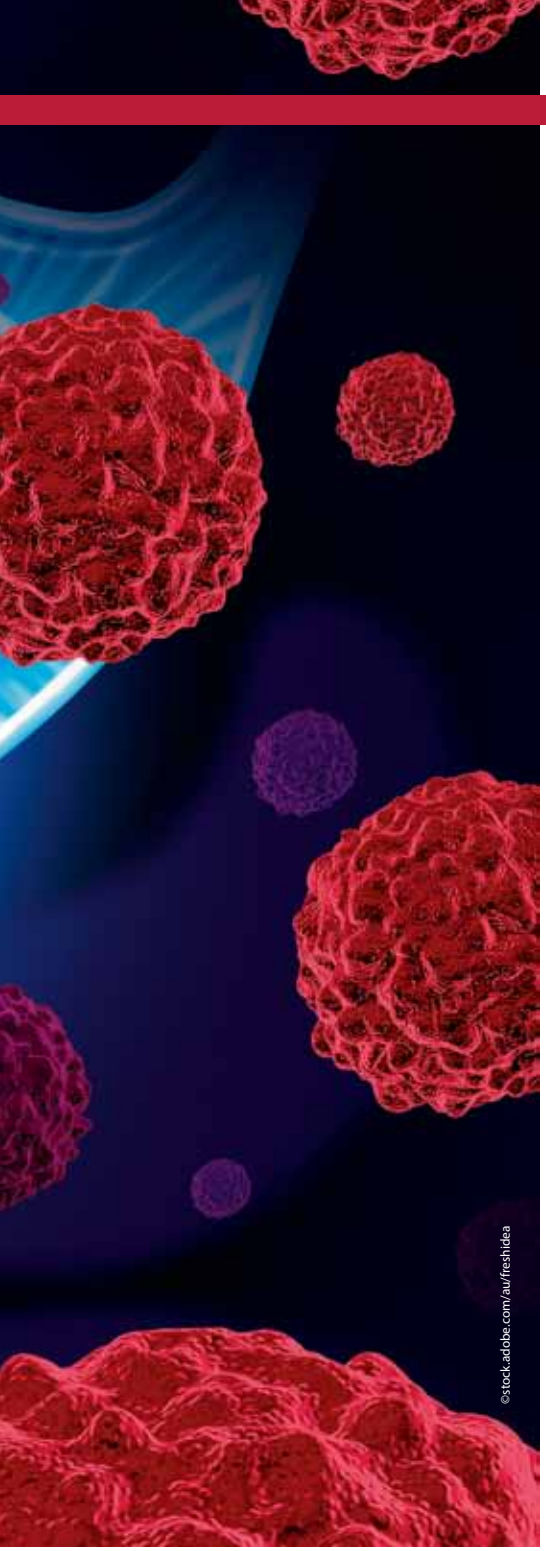
For example, Japanese scientists led by Kanazawa University have identified compounds found in coffee which may inhibit the growth of prostate cancer. Their work has been published in the journal *The Prostate*.

Coffee is a complex mixture of compounds which has been shown to influence human health, and there is increasing evidence that drinking certain types of coffee is associated with a reduction in incidence of some cancers, including prostate cancers. With this in mind, researchers tested six compounds, naturally found in coffee, on the proliferation of human prostate cancers cells in vitro — cells which are resistant to common anticancer drugs such as Cabazitaxel.

They found that cells treated with kahweol acetate and cafestol — hydrocarbons naturally found in Arabica coffee — grew more slowly than controls. They then tested these compounds on prostate cancer cells which had been transplanted to mice. Four mice were controls, four were treated with kahweol acetate, four were treated with cafestol and four were treated with a combination of kahweol acetate and cafestol.

"We found that kahweol acetate and cafestol inhibited the growth of the cancer cells in mice, but the combination seemed to work synergistically, leading to a significantly slower tumour growth than in untreated mice," said study leader Dr Hiroaki Iwamoto. "After 11 days, the untreated tumours had grown by around three-and-a-half times the original volume (342%), whereas the tumours in the mice treated with both compounds had grown by around just over one-and-a-half (167%) times the original size.

"This is a pilot study, so this work shows that the use of these compounds is scientifically feasible, but needs further investigation; it does not mean that the findings can yet be applied to humans. We also



found the growth reduction in transplanted tumour cells, rather than in native tumour cells. What it does show is that these compounds appear to have an effect on drug-resistant prostate cancer cells in the right circumstances, and that they too need further investigation. We are currently considering how we might test these findings in a larger sample, and then in humans."

"These are promising findings, but they should not make people change their coffee consumption," added co-author Professor Atsushi Mizokami. "Coffee can have both positive and negative effects (for example, it can increase hypertension), so we need to find out more about the mechanisms behind these findings before we can think about clinical applications. However, if we can confirm these results, we may have candidates to treat drug-resistant prostate cancer."

Meanwhile, a separate study saw US researchers reveal that testosterone replacement actually slows the recurrence of prostate cancer in low-risk patients, calling into question Huggins and Hodges' research from 1941 that a reduction in testosterone was linked to a reduction in prostate cancer — research which won Huggins the 1966 Nobel Prize for Medicine. Since then, medicines which reduce testosterone levels have become a standard option for many patients.

But from the late 1990s onwards, doctors began to find that although men on long-term anti-testosterone treatments were not dying from prostate cancer, they were dying prematurely of cardiovascular disease. It seemed that although anti-testosterone therapies were treating the prostate cancer, the extremely low testosterone levels were significantly worsening metabolic complications such as elevated blood sugar, diabetes, elevated cholesterol, mid-abdomen visceral fat, etc, as well as causing a loss of sexual function. This led some doctors to suggest testosterone replacement in some low-risk men after radiation or surgical treatment.

Starting in 2008, a team of doctors from the University of California, Irvine began to carefully select patients for testosterone replacement after primary treatment of prostate cancer with robotic radical prostatectomy, in hopes of improving recovery of sexual function. The team worked with 834 patients undergoing radical prostatectomy, treating 152 low-risk patients with no evidence of disease with testosterone replacement therapy.

After a median of 3.1 years following surgery, the researchers tested the patients for biochemical recurrence of the cancer, as indicated by measurement of the prostate-specific antigen (PSA) levels. They found that the cancer had recurred in only approximately 5% of treated patients, whereas the cancer had recurred in 15% of the patients who did not receive testosterone. Overall, after accounting for differences between the groups, they found nearly a three-fold reduction by three years.

"This is not what we set out to prove, so it was a big surprise: not only did testosterone replacement not increase recurrence, but it actually lowered recurrence rates," said study leader Professor Thomas Ahlering. "While the testosterone is not curing the cancer per se, it is slowing the growth of the cancer, giving an average of an extra 1.5 years before traces of cancer can be found. We already know that testosterone can help with physiological markers such as muscle mass, better cholesterol and triglyceride levels and increased sexual activity, so this seems to be a win-win.

"There have been smaller studies which have hinted that testosterone may not be risky for certain patient groups, but this is the largest such study ever conducted. We're not suggesting that treatment methods be changed just yet, but this puts us at the stage where we need to question the taboo against testosterone use in prostate cancer therapy — especially for low-risk patients after radical prostatectomy."

In fact, there may be an additional reason why anti-testosterone treatment should be reviewed. Another study presented at the congress, this time by Danish researchers, found that men who receive anti-hormonal treatment after having their prostate removed are 80% more likely to suffer from depression than men who don't receive this treatment.

Increasingly, doctors are becoming aware that for many men, a cancer diagnosis and treatment leads to depression, with suicide rates seen rising disproportionately for those with urological cancers. Examining the medical records of 5570 men from the Danish Prostate Cancer Registry, researchers found that 773 had been treated for depression after surgery. They found that men treated with anti-hormonal medicines were 1.8 times more likely to suffer from depression than men who did not receive the additional treatment.

"We know from other studies that low testosterone can affect a man's wellbeing, so it may be that limiting testosterone production might have the same effect, perhaps especially after a major stress such as cancer treatment," said lead researcher Dr Anne Sofie Friberg from the Rigshospitalet in Copenhagen.

"It is important to note that compared to men without prostate cancer, the patients treated with prostatectomy as a whole had an increased risk of depression. After surgery, erectile dysfunction and urinary incontinence are frequent symptoms. In case of recurrence and hormonal treatment, these symptoms may worsen and, in addition, altered body image and loss of libido are common. These treatment effects are likely to increase the risk of depression. Also, low testosterone levels may directly affect mood centres of the brain.

"As many as 25% of men undergoing radical prostatectomy will relapse and may be offered hormonal treatment. These men appear to be at a higher risk of developing depression once hormonal treatment is introduced. The reason could be either a consequence of failing surgery, directly caused by the hormonal manipulation, or both."

Mobile breathing assistance for premature infants

medin Medical Innovations is a Munich-based medical device manufacturer that develops and sells innovative CPAP systems for newborns and premature infants treated in intensive care units. The company's latest product development — medinCNT — was the result of a joint development project with Bürkert.

In some cases, the breathing of newborns needs to be supported through intensive medical provisions. If the young patient shows signs of natural spontaneous breathing, the application of CPAP (continuous positive airway pressure) is usually the therapy of choice. This maintains the functional residual capacity of premature and newborn babies without the need for intubation, while ensuring an optimum supply of oxygen and training the relevant muscles.

Independently operating mobile systems are becoming increasingly popular in delivery rooms, ambulances and intensive care units. To address and tackle the considerable technical challenges involved in developing such a system, such as the precise recording and control of required gas volumes, concentration and pressures required for the baby, medin turned to the experts at Bürkert. Utilising medin's expert knowledge in respiration technologies for intensive care scenarios, engineers at Bürkert created a compact system solution with a modular control block to meet all requirements.

At the heart of the innovative ventilation device is an electronic gas mixer which consists of a compact control block, the mixing and measuring equipment, fitted control electronics, valves and silencers. In addition, the system contains oxygen sensors, a pressure-relief valve and connecting threads for the air and oxygen inlet and for the outlet of the gas mixture.

Thanks to Bürkert's ultraprecise proportional valves, the gas mixer controls the oxygen concentration and the desired flow rate "effectively and efficiently", according to medin Technical and Marketing Manager Paul Schmitgen. The valves offers frictionless operation, combined with fast response times, dynamic performance and high repeat accuracy of ±0.25% — even more precise than the maximum deviation of ±2% required by current medical standards.

The result is a ventilation device that works without a compressor, thanks to the built-in turbine. Since it only needs to be connected to an oxygen cylinder instead of a central gas supply, the independently operating, compact device is transport-friendly and thus suitable for mobile use. Bürkert has thus contributed to an efficient therapy solution for young patients, making sure their lungs receive the support they need for a good start in life.

Burkert Fluid Control Systems
www.burkert.com.au

Electrophysiological data analysis software

BrainWave 4 from 3Brain is an acquisition and analysis software tool designed to manage high-content electrophysiological data sets. It offers real-time visualisation and the data extraction of key metrics gathered using 3Brain's microelectrode array (MEA) platforms.

The feature-rich software allows users to filter the data, detect and sort spikes in activity, analyse local field potentials (LFPs) and more. Applications include research in drug discovery, brain organoids, brain slices, neuronal networks, animal- and human-derived stem cells and the retina.

BrainWave 4 pairs with 3Brain's CMOS-based high-density multielectrode arrays (CMOS MEAs) to visualise, record and analyse electrophysiological cell activity in real time. Customisable display tools show this dense data in a user-friendly video interface. Pixels on the colour-coded activity map correspond with the 4096 electrodes, with changes in colour representing activity spikes/voltage traces. Sophisticated algorithms make it possible to observe spatial distribution and activity patterns and detect isolated signals.

The wide array of selection tools provides a number of ways to organise and analyse HD electrophysiological data. With the magic wand tool, the software automatically selects and visualises the most active electrodes in a particular region. Manual selection tools (single-channel, lasso, shape selection and brush) meanwhile make it possible to view electrophysiological activity in a small or large area by selecting single or multi channels.

BrainWave 4 performs both real-time and offline analyses on the HD electrophysiological data collected on 4096 channels. After spike detection or LFP detection (available online and offline) is configured and run, many calculations are possible.

The software offers a host of compression strategies to simplify data management and save space on the user's hard disk. Data is stored using an HDF5 hierarchical data format. This open-source, cross-platform, large data storage solution is supported by data analysis platforms like Python, Matlab, Scilab, Octave and R. Charts and images generated from raw data can be exported as Microsoft Excel spreadsheets.

SciTech Pty Ltd
www.scitech.com.au

Reprogrammed pancreatic cells

relieve diabetes in mice

A new study led by the University of Geneva (UNIGE) has demonstrated how some human pancreatic cells can be reprogrammed to produce insulin, potentially compensating in diabetics for the loss or dysfunction of cells that naturally produce this hormone. Their work has been published in the journal ***Nature***.

The human pancreas harbours several types of endocrine cells (α, β, δ, ε and ϒ) that produce different hormones responsible for regulating blood sugar levels. These cells are bundled into small clusters, called pancreatic islets or islets of Langerhans. Diabetes occurs when, in the absence of functional β cells, blood sugar levels are no longer controlled.

At the UNIGE Faculty of Medicine, Professor Pedro Herrera and his team had already demonstrated, in mice, that the pancreas has the ability to regenerate new insulin cells through a spontaneous mechanism of identity change of other pancreatic cells. But what about in human beings? And is it possible to artificially promote this conversion?

To explore whether human cells have this ability to adapt, the scientists used islets of Langerhans from both diabetic and non-diabetic donors. They first sorted the different cell types to study two of them in particular: α cells (glucagon producers) and ϒ cells (pancreatic polypeptide cells).

"We divided our cells into two groups: one where we introduced only a fluorescent cell tracer, and the other where, in addition, we added genes that produce insulin transcription factors specific to β cells," Prof Herrera explained. The researchers then reconstructed 'pseudo-islets', with only one cell type at a time to accurately study their behaviour.

"First observation: the simple fact of aggregating cells, even into monotypic pseudo-islets, stimulates the expression of certain genes linked to insulin production, as if the 'non-β' cells naturally detected the absence of their 'sisters'," said Kenichiro Furuyama, a researcher at UNIGE and first author on the study. "However, in order for the cells to start producing insulin, we had to artificially stimulate the expression of one or two key β cell genes."

One week after the experiment began, 30% of the α cells were producing and secreting insulin in response to glucose. ϒ cells, under the same treatment, were even more effective and numerous in converting and secreting insulin in response to glucose.

In a second step, the researchers transplanted these monotypic pseudo-islets of modified human α cells into diabetic mice. Prof Herrera recalled, "Human cells proved to be very effective — the mice recovered! And as expected, when these human cell transplants were removed the mice became diabetic again.

"We obtained the same results with cells from both diabetic and non-diabetic donors, showing that this plasticity is not damaged by the disease. In addition, this works in the long term: six months after transplantation, the modified pseudo-islets continued to secrete human insulin in response to high glucose."

A detailed analysis of these human glucagon cells that have become insulin producers shows that they retain a cell identity close to that of α cells. With autoimmune diabetes (type 1 diabetes) characterised by the destruction of β cells by the immune system of patients, the researchers wondered whether these modified α cells would also be targeted by autoimmunity, since they remain different from β-cells.

To test their resistance, the researchers co-cultured these modified cells with T cells from patients with type 1 diabetes. They found that modified α cells triggered a weaker immune response, and therefore might be less likely to be destroyed than native β cells.

The researchers believe their research may one day be used as a substitute for pancreas transplantation, which is currently performed in cases of extremely severe diabetes and involves transplanting either the entire pancreas or, preferably, only pancreatic islets. This technique is very effective, but, like any transplant, it goes hand in hand with immunosuppressive treatment. The transplanted cells also disappear after a few years.

"The idea of using the intrinsic regenerative capacities of the human body makes sense here," Prof Herrera said. However, many hurdles remain before a treatment resulting from the team's discovery can be proposed.

"We must indeed find a way — pharmacological or by gene therapy — to stimulate this change of identity in the cells concerned within the patient's own pancreas, but without causing adverse effects on other cell types."

Plasma FIB-SEM

The TESCAN S8000X Xe plasma FIB-SEM offers versatility, ultrahigh-resolution imaging and high-speed nanomachining capabilities. It combines TESCAN's BrightBeam SEM column with its iFIB+ focused ion beam column.

The BrightBeam SEM column affords users field-free, ultrahigh-resolution (UHR) imaging. It features electron optics that improve resolution even at low beam energies, making it suitable for examining challenging non-conductive specimens and useful for the requirements of researchers involved with cutting-edge aspects of material science, eg, nanotechnology/ nanomaterials, semiconductors, with additional applications in life science and geosciences.

The iFIB+ Xe plasma FIB column offers good field of view, resulting in the ability to carry out large area cross-sectioning, as well as offering high levels of automation. Using Xe avoids the drawbacks associated with Ga implantation, which can easily alter the sample's physical properties or poison it. In addition, smaller amorphous layers are produced due to the limited range of Xe ions in materials in comparison with Ga. The S8000X also permits live SEM monitoring of the FIB milling process.

The product benefits from TESCAN's easily customisable Essence user interface. Each user can have their own application-oriented interface that provides access to the features and functionalities that they need, while those that they don't can be tucked away. The user interface enables fast, smooth instrument operation and is designed to enhance the user experience for operators of all levels of experience.

AXT Pty Ltd
www.axt.com.au

Modular balances

For scientists in R&D and analytical laboratories needing trustworthy lab weighing results, the Cubis II from Sartorius is a completely configurable, high-performance portfolio of balance hardware and software that will align with each user's demands and compliance requirements to maximise operational efficiency and experimental outcomes.

The Cubis II platform is said to be the only laboratory balance with fully customisable hardware, software and connectivity. It offers modern user interfaces and pharmaceutical and GxP compliance, including data handling, data integrity and connectivity, ergonomic sample handling, easy process integration and unlimited communication at a high level of precision.

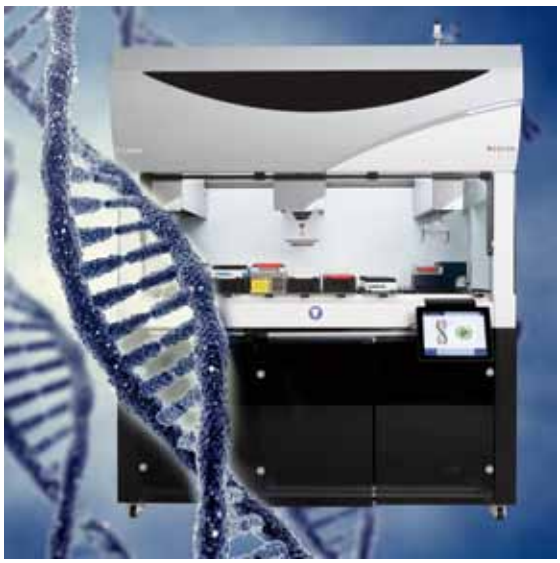
Sartorius Australia Pty Ltd
www.sartorius.com

Library preparation method

Tecan has launched NGS DreamPrep, a fully automated approach to next-generation sequencing (NGS) library preparation for research use. Designed to offer improvements in speed, flexibility and precision, the approach enables quality-controlled, sequencing-ready NGS libraries in just a matter of hours, with minimal manual interaction and no sample loss.

NGS experiments are time-consuming, expensive and generate vast quantities of data. This makes it particularly important that they are based on high-quality libraries that will yield valuable results. NGS DreamPrep is designed to achieve quantification, normalisation and pooling of samples in significantly shorter timelines compared to other methods that use qPCR or capillary electrophoresis.

The walkaway solution combines the Tecan Fluent liquid handler and Infinite plate reader, together with Celero DNA-Seq and Universal Plus mRNA-Seq library preparation kits. It is said to be the first library preparation method to incorporate a QC step, which takes just 5 min, ensuring the generation of reproducible libraries that are ready to sequence.



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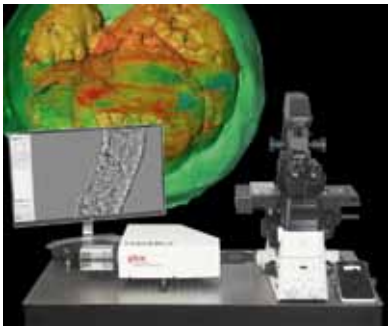


Gradient light interference microscopy for inverted microscopes

Multiple scattering limits the contrast in optical imaging of thick specimens. Gradient light interference microscopy (GLIM) is a quantitative phase imaging (QPI) technique that can address this issue and can be added to the user's existing inverted microscope.

GLIM is non-invasive, label-free and requires no sample preparation. It is suitable for both short- and long-term dynamic biological studies with imaging timeframes from milliseconds to days. With the ability to work with single cell layers up to large whole organisms (greater than 350 μm thick), the technique generates quantitative data and can be combined with standard imaging modalities.

GLIM provides high-quality quantitative data by combining multiple intensity images corresponding to controlled phase shifts between two interfering waves. This suppresses incoherent background due to multiple scattering seen with standard transmitted imaging. It exploits a special case of low-coherence interferometry to extract phase information from 2D and 3D samples, which in turn can be used to measure cell mass, cell volume, surface area and cellular evolution as a function of time.

GLIM is supplied as a module and is a simple upgrade to existing inverted DIC (differential interference contrast) microscopes, attaching via the C-mount. It integrates with existing contrast techniques (ie, fluorescence) and dimensions (X-Y scanning, Z-stacking, etc) to provide additional analytical capabilities for thick specimens.

AXT Pty Ltd
www.axt.com.au

Ultrafast laser system

There is growing need for laser sources that operate in the visible spectrum, due to applications such as photodynamic therapy, multiphoton imaging and the development of nanoparticle technologies. The Chromacity 520 ultrafast laser system provides more than 500 mW in the visible region.

The product features an air-cooled, compact, ultrafast ytterbium fibre-based laser delivering high performance with turnkey operation. The instrument provides a fixed 520 nm output at a power of 500 mW to 1 W and is essentially a frequency-doubled version of the company's flagship 1040 nm laser, the Chromacity 1040.

The laser system also provides the option to deliver dual output at 520/1040 nm from a single unit and is a useful source for a wide range of nonlinear optics, microscopy and spectroscopy applications. The system delivers <250 fs pulse width, which makes it suited to a wide range of photonics and imaging applications. For microscopy, the laser light can be split between more than one microscope set-up.

Machined from a single block of high-grade aluminium, the laser system has been designed specifically to deliver ultrashort pulses. This has been brought about, in part, by fully integrating the pump source and removing the need for water cooling. An intuitive web-based user interface allows for easy control of the system; this relaxes the constraints of having to be near the laser system to use it. The standard model operates at a pulse repetition frequency of 100 MHz, making it easy to integrate with a range of diagnostic equipment.

SciTech Pty Ltd
www.scitech.com.au

16- and 24-well multichannel pipettes

Eppendorf has extended its liquid handling portfolio with the launch of the Research plus and electronic Xplorer plus 16- and 24-well multichannel pipettes and epTIPS 384 to enable the convenient pipetting of entire columns and rows of a 384-well plate.

The system uses SOFTattach technology with tip elasticity for good tip fit and seal as well as a spring-loaded tip cone to reduce tip attachment forces for ergonomic handling.

A fine tip shape facilitates manoeuvrability of samples accurately into the wells of a 384-well plate.

The 16- and 24-well multichannel pipettes and epTIPS 384 are designed to improve efficiency and reproducibility and save users time when working with 384-well plates.

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

Spark-free laboratory fridge-freezer with electronic controller

Purpose-built with a spark-free interior, the 361-litre Spark-free Laboratory Fridge-Freezer with electronic controller (LCexv 4010) is certified to EU directive 94/9/EC (ATEX) and rated II 3/-G IIB+H2 T6 for the storage of flammables in partially opened containers. Suitable for laboratories that have limited space, the unit is small in footprint, with a 254-litre fridge compartment on top and a 107-litre freezer compartment below.

Flammables can be optimally stored between 3°C and 16°C in the fridge and between -9°C and -30°C in the freezer, and temperature can set to 1/10°C accuracy using the electronic controller. For optimal cooling efficiency, the fridge has a dynamic cooling system with automatic defrost while the freezer is static and requires manual defrost.

An integrated data memory in the electronic controller logs min/max temperature and the last three alarm events for 41 days, plus temperature data and alarms can be transferred to a remote monitoring system using the RS 485 serial communication port. Visual and audible alarms alert users of cold chain breaches and these can be forwarded to email, phone etc, via floating alarm contact.

The Spark-free Laboratory Fridge-Freezer has a keypad lock to prevent temperature and alarm settings changes and is fitted with physical locks to protect against unauthorised access. Eco-friendly and energy efficient, it allows the user to enjoy running cost savings for the life of the product.

Andi-Co Australia
liebherrprofessional.com.au

16-channel manual pipettes

INTEGRA Biosciences is expanding the EVOLVE manual pipette range with the launch of the 16-channel EVOLVE.

Ergonomically designed to increase productivity and improve user handling, the device is available in 10, 50 and 100 µL formats. The 16-channel option features 4.5 mm tip spacing, suitable for working with 384-well plates, reducing the number of pipetting movements and increasing reproducibility.

The pipettes use three adjustable dials for individually setting each decimal, unlike the single rotating plunger seen on traditional manual pipettes. This is designed to reduce repetitive stress injuries and enable users to set volumes in a fraction of the time, increasing efficiency — especially when adjusting from low to high volumes and vice versa.

The EVOLVE family now includes a full line of single, 8-, 12- and 16-channel manual pipettes, covering a volume range of 0.2 to 5000 µL.

BioTools Pty Ltd
www.biotools.com.au

Lab-on-a-chip detects ovarian cancer with a liquid biopsy

Researchers at the University of Kansas (KU) have developed an ultrasensitive diagnostic device, or lab-on-a-chip, that could allow doctors to detect cancer quickly from a droplet of blood or plasma — leading to timelier interventions and better outcomes for patients.

Described in the journal *Nature Biomedical Engineering*, the lab-on-a-chip is designed to detect exosomes — tiny parcels of biological information produced by tumour cells to stimulate tumour growth or metastasize. As explained by lead author Yong Zeng, exosomes were originally believed to be "trash bags that cells could use to dump unwanted cellular contents — but in the past decade, scientists realised they were quite useful for sending messages to recipient cells and communicating molecular information important in many biological functions".

"Basically, tumours send out exosomes packaging active molecules that mirror the biological features of the parental cells," Zeng said. "While all cells produce exosomes, tumour cells are really active compared to normal cells."

The lab-on-a-chip utilised a 3D nanoengineering method that mixes and senses biological elements based on a herringbone pattern commonly found in nature, efficiently pushing exosomes into contact with the chip's sensing surface in a process called 'mass transfer'.

"People have developed smart ideas to improve mass transfer in microscale channels, but when particles are moving closer to the sensor surface, they're separated by a small gap of liquid that creates increasing hydrodynamic resistance," Zeng said. "Here, we developed a 3D nanoporous herringbone structure that can drain the liquid in that gap to bring the particles in hard contact with the surface where probes can recognise and capture them."

Zeng compared the chip's nanopores to a million little kitchen sinks: "If you have a sink filled with water and many balls floating on the surface, how do you get all the balls in contact with the bottom of the sink where sensors could analyse them? The easiest way is to drain the water."

To develop and test the microfluidic device, Zeng teamed with KU Cancer Center Deputy Director Andrew Godwin, as well as graduate student Ashley Tetlow, in Godwin's Biomarker Discovery Lab. The collaborators tested the chip's design using clinical samples from ovarian cancer patients, finding the chip could detect the presence of cancer in a minuscule amount of plasma.

"Our collaborative studies continue to bear fruit and advance an area crucial in cancer research and patient care — namely, innovative tools for early detection," Godwin said. "This area of study is especially important for cancers such as ovarian, given the vast majority of women are diagnosed at an advanced stage when, sadly, the disease is for the most part incurable."

What's more, the KU microfluidic chips would be cheaper and easier to make than comparable designs, allowing for wider and less-costly testing for patients.

"What we created here is a 3D nanopatterning method without the need for any fancy nanofabrication equipment — an undergraduate or even a high school student can do it in my lab," Zeng said. "This is so simple and low-cost it has great potential to translate into clinical settings."

With the microfluidic chip's design now proven using ovarian cancer as a model, Zeng believes the chip could be useful in detecting a host of other diseases. He said he has been collaborating with Godwin and other research labs and departments at KU in order to further explore the translational applications of the technology.

"Now we're looking at cell-culture models, animal models and also clinical patient samples, so we are truly doing some translational research to move the device from the lab setting to more clinical applications," he said. "Almost all mammalian cells release exosomes, so the application is not just limited to ovarian cancer or any one type of cancer. We're working with people to look at neurodegenerative diseases, breast and colorectal cancers, for example."

Analytical testing products

Megazyme offers high-purity, ultrastable products used in analytical testing across a range of industries — from cereals and food manufacturing, to biofuel and animal feed, to wine, beer and dairy products.

The company's biochemical assay kits cater to a wide range of industries and use only high-quality enzymes and reagents. When coupled with the company's various analysers, a bespoke solution for users at every level is available.

The company also offers a range of enzyme products, including Analytical Enzymes, Carbohydrate Active enZYmes, Glycobiology Enzymes and ANKOM Dietary Fiber Enzymes. This is in addition to enzyme substrates, including Enzyme Activity Assay Kits, Colourimetric Oligosaccharides, Enzyme Tablet Tests, Insoluble Chromogenic Substrates and Soluble Chromogenic Substrates.

Megazyme's chromogenic substrates meanwhile provide convenient methods for the assay of hydrolytic enzymes. As the native substrates, polysaccharides and oligosaccharides can give the truest insight into their mechanism of action, active site requirement, binding affinities and activities.

The company also offers a range of chemicals — including analytical standards, buffers, celite/resins/chemicals, cofactors and stains — as well as analytical equipment used for the measurement of enzyme activity, biochemical enzyme assays, research and analytical applications.

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

Spectrophotometers for water analysis

The XD series of spectrophotometers from Lovibond are suitable for routine water analysis, especially spectral analysis. The XD 7000 and XD 7500 UV and UV/VIS devices can be used for disinfectant control, wastewater and raw water treatment, drinking water treatment, the analysis of boiler and cooling water or for pool water control, and swimming pool water treatment.

Everything the user needs comes from a single source, including the barcoded cell test. It is easy to select the correct test method directly from the instrument. Using the external barcode scanner, the suitable analysis method can also be selected on reagent packaging, in the Lovibond Handbook of Methods or with specifically requested barcoded templates for the user's own SOPs.

The instruments automatically recognise the most common cuvettes in the most common sizes, report the use of an incorrect cuvette or adjust the measuring range. This should make annoying detours and time-consuming extra work processes a thing of the past.

The instruments of the XD series also offer support for analytical quality assurance. User-defined calibration, password control and automatic logging are just some of the options. In addition, the instruments provide simple user guidance and global usability due to multilingualism on all important levels.

The Lovibond Handbook of Methods offers valuable support for many analytical questions and applications.

Tintometer GmbH
www.lovibond.com

Corrosion-resistant analog hot plates and stirrers

Torrey Pines Scientific announces its line of corrosion-resistant, multiposition stirring analog hot plates and stirrers featuring five or nine stirring positions, making them suitable for acid digestions and working with most corrosive solutions.

The large 305 mm square ceramic heater tops have a temperature range to 450°C. A purge port on the rear on the units is provided for purging with a positive pressure of any inert gas. Most chassis openings have been closed. This keeps corrosive vapours from getting inside the units and protects the electronics and stirrer motors.

The five-position stirring units can stir 5–800 mL beakers, and the nine-position units can stir 9–500 mL beakers of corrosive aqueous solutions from 100 to 1500 rpm. Each stirring position is individually controlled.

Measuring 432 x 318 x 134 mm, the units can support more than 22.6 kg on the plate surface. All controls are mounted well away from the heater surface to protect against accidental burns, and the units are designed to keep spills out of the chassis.

The units are available in 115 VAC/60 Hz, 220 VAC/60 Hz and 230 VAC/50 Hz. They have a main AC on/off switch and are fused for safety. They are supplied with a user's manual and detachable line cord for the country of use. All units are UL, CSA and CE or equivalent rated.

Edwards Group Pty Ltd
www.edwardsco.com.au

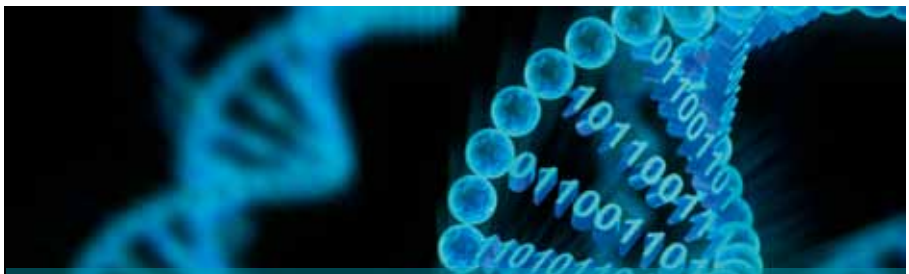
Headspace sampling system

Routine testing and quality control (QC) laboratories can enhance the performance of daily workflows with access to the Thermo Scientific TriPlus 500 Gas Chromatography Headspace Autosampler — a static headspace sampling system that is expected to provide high productivity and fast analysis for volatile organic compounds (VOCs) across all sample types. The product is designed for high sample throughput for routine VOCs analysis by pharmaceutical, food safety and environmental scientists.

Adhering to global standards for data quality, the platform is designed to provide: high performance, for confidence in data reproducibility and sample integrity; automated 24/7 operation; validated method transfer capabilities, which help streamline method conversion; effective purging to practically eliminate the residual signal of heavier and polar compounds, for minimal carryover; pressure control in both the vial and sampling loop prior to column transfer; efficient heating of the sample path, which protects against the risk of high boiling solvent contamination and supports the robustness of the system; and a scalable and compact design to maximise bench space and meet evolving throughput requirements.

Laboratories that need to comply with stringent regulatory requirements can benefit from the complete integration of the TriPlus 500 Gas Chromatography Headspace Autosampler with the Thermo Scientific Chromeleon Chromatography Data System (CDS) software, which is designed with the necessary functionality to achieve full compliance and adherence to data quality guidelines (USP<1058>) as well as 21 CFR Part 11 for data integrity and traceability. This combination provides dedicated tools for automatic reporting and system suitability testing to help organisations meet the latest standards and streamline their validation procedures.

Thermo Fisher Scientific
www.thermofisher.com.au



43rd Human Genetics Society of Australasia (HGSA) Annual Scientific Meeting

August 3–6, Wellington, New Zealand

The theme for this conference is Winds of Change, to convey the importance of new developments in genetics and genomics (including therapeutics), cancer genetics and engaging with the broader community, in particular indigenous populations. The conference will cover various aspects of human genetics and genomics, with sessions around the following topics: new developments in genomic medicine; translation, discoveries and therapies; ethics; engagement with indigenous communities; cancer genetics.

https://www.hgsa.org.au/about/43rd-annual-scientific-meeting

10th International Particle Accelerator Conference
May 5–10, Melbourne
https://ipac19.org/

ASID Annual Scientific Meeting 2019
May 16–18, Darwin
https://www.asid.net.au/meetings/asid-annual-scientific-meeting-2019

3rd ANZMBS Conference 2019
May 20–22, Sydney
https://anzmbs.asn.au/2019-conference/

13th International Conference on Fundamentals of Adsorption
May 26–31, Cairns
https://foa2019.com/

Collaborate | Innovate | 2019
May 28–30, Adelaide
https://collaborateinnovate.com.au/

AMOS-ICTMO 2019
June 11–15, Darwin
https://www.amos.org.au/event/amos-ictmo-2019/

International Conference on Cytochrome P450
June 23–27, Brisbane
https://my.vanderbilt.edu/p450meetings/

ASM 2019
June 30–July 3, Adelaide
http://asmmeeting.theasm.org.au/

42nd MERGA Conference
June 30–July 4, Sydney
http://www.promaco.com.au/events/MERGA/

AMSA 2019: Marine Science for a Blue Economy
July 7–11, Perth
http://amsa19.amsa.asn.au/

19th International Zeolite Conference
July 7–12, Perth
http://izc19.com/

International Congress of Mucosal Immunology
July 16–20, Brisbane
http://www.socmucimm.org/

Pathology Horizons 2019
August 8–10, Queenstown, New Zealand
https://pathologyhorizons.com/

Science meets Parliament 2019
August 13–14, Canberra
https://scienceandtechnologyaustralia.org.au/

2019 Australian Genomics National Conference
September 5–6, Melbourne
https://www.australiangenomics.org.au

7th Annual Heavy Ion Accelerator Symposium on Fundamental and Applied Science
September 11–13, Canberra
http://hias.anu.edu.au/2019/

14th World Congress on Inflammation
September 15–19, Brisbane
https://www.wci2019.org/

19th Biennial Meeting of the International Council for NIR Spectroscopy
September 15–20, Gold Coast
http://www.nir2019.com/

International Conference on Materials Science and Engineering
September 16–18, Melbourne
https://www.materialsconferenceaustralia.com/

IUMRS-ICA 2019
September 22–26, Perth
https://iumrs-ica2019.com/

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A.B.N. 22 152 305 336
www.wfmedia.com.au

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

Editor
Lauren Davis
LLS@wfmedia.com.au

Publishing Director/MD
Geoff Hird

Art Director/Production Manager
Julie Wright

Art/Production
Colleen Sam

Circulation
Dianna Alberry, Sue Lavery
circulation@wfmedia.com.au

Copy Control
Mitchie Mullins
copy@wfmedia.com.au

Advertising Sales

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

Nikki Edwards
Ph: 0431 107 407
nedwards@wfmedia.com.au

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

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

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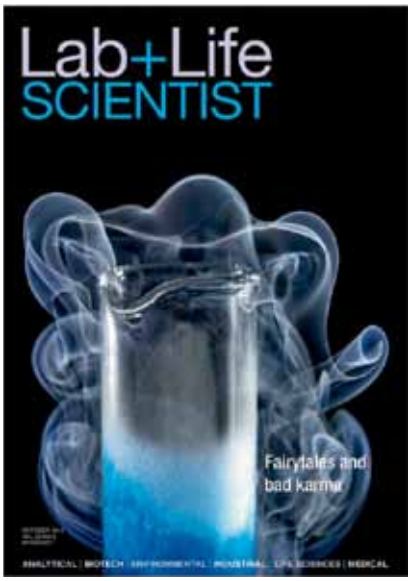

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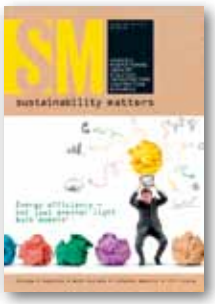

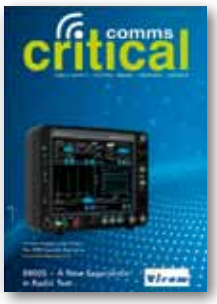

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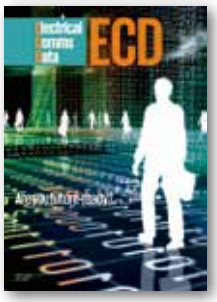

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