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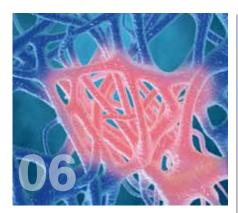
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Cover image shows the developing nervous system of a seven-day-old chicken embryo captured with a mesoSPIM microscope.

Image credit: mesoSPIM.org



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# Trick or treat?

My deadline sheet informs me that this issue of *Lab+Life Scientist* is due to reach readers on 31 October, aka Halloween — a celebration that has gained traction in Australia in recent years, possibly due to the fact that we live in an increasingly scary world. Personally, I'm hoping to see plenty of spooky, science-themed Halloween costumes this year — I'm thinking antibiotic-resistant bacteria, a planet that's been ravaged by human-induced climate change and genetic experiments that have gone horribly wrong.

... You're right, that's too dark even for Halloween.

Of course, we all know that science has overall helped humanity rather than hindered it — and in the event that scientists do discover something troubling, they have the opportunity to spread the word (through sources like this very magazine) and come together to devise a solution, or even to improve on the solutions of the past. To use one of the above topics as an example, researchers have recently made breakthroughs in combating drugresistant bacteria by utilising naturally occurring antibiotics — see the article on page 38 for more information.

Truthfully, one of the scariest things about Halloween is, like with most special occasions, the fact that it encourages us to celebrate with the consumption of lollies, caramel apples and other sweet treats that aren't particularly good for us — particularly for our guts. It was Hippocrates himself who famously claimed that all disease begins in the gut — and while this bold statement

may still be up for debate, scientists are beginning to discover that there's more than a grain of truth in Hippocrates' words. Indeed, this issue I was lucky enough to chat with two people who know a thing or two about the impact of the gut on our overall health: British science journalist Dr Michael Mosley and Canadian physician-scientist Professor Daniel Drucker.

I heard from Dr Mosley when he came to Sydney to present at the 14th World Congress on Inflammation, held in mid-September. Dr Mosley was an extremely charismatic speaker, easily holding the attention of the 1000+ attendees who had come to hear him talk about how inflammation plays a role in a whole host of diseases, and how we can change our diet — and thus our gut microbiome — in order to combat this. I for one walked away with more than a few tips, which I have already started to utilise in my daily life.

Prof Drucker, meanwhile, spoke to *LLS* ahead of his upcoming oration at the 58th ASMR National Scientific Conference 2019, to be held in Fremantle from 20–21 November. His is a fascinating story that charts a series of breakthroughs surrounding the role played by gut hormones, many of these occurring purely by chance. It's an inspiring tale that I hope will encourage all budding scientists out there to pursue any morsels of data that you find particularly interesting as you embark on your research journey — even if they have nothing to do with what you were originally looking for.

Happy reading!

Regards, Lauren Davis LLS@wfmedia.com.au



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Email: sales@starna.com.au www.starna.com At the 14th World Congress on Inflammation, held in Sydney from 15–19 September, attendees learned that inflammation lies at the heart of almost all disease. But what can be done about it? British physician, science journalist and documentary maker Michael Mosley had a few tips.

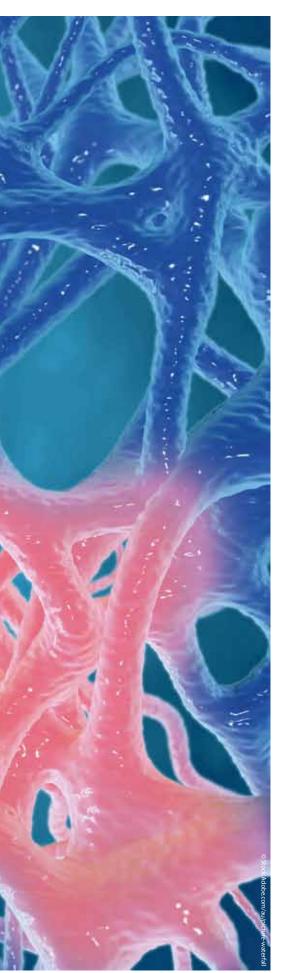
r Mosley attended the Congress as a guest of the Centenary Institute — an independent medical research institute located on the campus of the Royal Prince Alfred Hospital. With inflammation being one of its key areas of focus, the institute was all too happy to host a free public lecture (the Centenary Oration) as part of the Congress — giving Dr Mosley a platform to explain in lay terms exactly what inflammation is, what it does and how it can be controlled.

When working properly, inflammation is the body's way of protecting us from microbes and pathogens — for example, by creating swelling around a wound. Chronic inflammation is what occurs when the immune system becomes overreactive, and it can lead to a range of inflammatory diseases. Heart disease, type 2 diabetes and cancer are all "unequivocally linked with inflammation", Dr Mosley said, and evidence suggests that an inflammatory element is also present in mental and neurological disorders such as dementia, depression and anxiety.

So what causes this overproduction of inflammatory signals? According to Dr Mosley, some of the key culprits include smoking, stress, lack of sleep and obesity — particularly visceral fat around the stomach.

"A recent paper showed that abdominal fat secretes chemicals that promote insulin resistance and inflammation," he said. "So the stuff in your gut is not passive. It seems to be different to fat on





Intermittent energy restriction reduces inflammation and improves chronic inflammatory diseases, without affecting the immune system's response to acute infections.

the breast, fat on the bottom. It seems to induce inflammatory change."

Dr Mosley has first-hand experience of inflammatory disease, beginning when his father died from complications relating to type 2 diabetes including dementia and heart disease. So when Dr Mosley himself was diagnosed with type 2 diabetes back in 2012, he set out on a mission to reverse it — which is how he first came across the idea of intermittent fasting, also known as intermittent energy restriction.

Dr Mosley revealed that interest in intermittent fasting began back in the 1930s, during the height of the Great Depression, when circumstances forced people to consume considerably fewer calories than they had before. The US Government, worried about the impact this would have on health, funded Cornell University research into the impact of living on two-thirds of one's normal calorie intake.

"They did it with rodents, and they expected the rodents to drop dead of a variety of illnesses — but to their great surprise, these rodents lived 50% longer than normal rodents," Dr Mosley said. "They had discovered the elixir of youth, quite inadvertently — the only thing that has ever been shown to extend a healthy life in every single species it has been tried on. And inflammation seems to be at the heart of that.

"More recently, when they looked back at the data from the Great Depression in America, life expectancy jumped by eight years across all groups. Didn't matter what social class you were, your ethnic origin, it jumped by eight years. Never been seen anywhere since, and they think that was to do with calorie restriction."

More recent data surrounding intermittent fasting comes from Mark Mattson, a professor of neuroscience at Johns Hopkins University and Chief Scientist at the National Institute on Aging. When he met with Dr Mosley, he revealed that in rodents, intermittent energy restriction protects against diabetes, cancer, heart disease and neurodegeneration — with particularly interesting results in mice that were destined to develop Alzheimer's disease. When the mice were put on a diet of feast days and fast days, they lived six months to a year longer with normal learning and memory before they started having problems. On the other hand, when they ate a fast food diet (emulated by the presence of fructose in their drinking water), onset of learning and memory problems began three to four months sooner.

"The mechanism seems to be something called BDNF — brain-derived neurotrophic factor," Dr Mosley explained. "And this is something which is released in the brain when you are doing fasting, intermittent fasting or indeed exercise. The great thing about BDNF is it encourages the growth of new brain cells. Indeed, what Mark found when he took the mice who had been on a calorie-restricted diet and he chopped their heads open, they had grown 40% new brain cells — particularly in the area of the brain associated with memory."

Prof Mattson explained that intermittent energy restriction reduces inflammation and improves chronic inflammatory diseases, without affecting the immune system's response to acute infections. This inspired Dr Mosley to come up with the 5:2 diet, which sees participants practise intermittent fasting (restricting themselves to 800 calories per day) on two days of each week. After using the technique himself for a period of eight weeks, he found he had shed 9 kg, lost 11 cm off his waist and returned his blood sugars to the normal range.

But intermittent fasting is not the only way to reduce weight or inflammation. Dr Mosley is also a big advocate for the Mediterranean diet, which is big on fruits and vegetables, nuts and legumes, olive oil and oily fish. The benefits of these food



groups were shown in the PREDIMED Study, Dr Mosley noted, which saw 7600 Spaniards randomly allocated to either a Mediterranean diet or a traditional low-fat diet.

"They had to stop the study early, 'cause it was obvious that one group was doing so much better than the other," he said. "They were 30% less likely to have heart attacks and strokes, cut their risk of developing diabetes by half — these are big numbers. And if you were a woman then it cut your risk of developing breast cancer by nearly 70%, and that seemed to be strongly linked with the nuts and with the extra-virgin olive oil. And it was also really good for your brain."

Indeed, the Mediterranean diet has also been shown to have positive effects on depression — as demonstrated by Professor Felice Jacka, who runs the Food & Mood Centre at Deakin University. Prof Jacka ran a 12-week trial with 67 participants who were either moderately or severely depressed and on heavy-duty antidepressants, assigning them either a Mediterranean diet or social support.

"What they found was, a third of those on the Mediterranean diet were able to come off all medication," Dr Mosley said. "And the closer you stuck to the Mediterranean diet, the more likely you were to put your depression into reverse. And interestingly enough, they took poo samples and it was all about the microbiome. If you changed your diet, and that changed your microbiome, then you saw the changes in depression scores."

Dr Mosley described the gut microbiome as like "a giant rainforest" teeming with a diverse range of bacterial species — some pro-inflammatory and some anti-inflammatory. But the quality of the microbiome has changed over the past 40 years or

so, he said, due to factors such as the prevalence of processed foods, overuse of antibiotics and the rise of caesarean sections. The rainforest has suddenly come under threat, and its long-time bacterial inhabitants — what Dr Mosley likes to call the "old friends" — are being rapidly depleted.

"We know this because they've collected frozen poo samples from kids from 40 years ago compared to now, and the diversity has gone down," he said. "A lot of the old friends are gone. These are the microbes that evolved with us over the last million years or so, and they are being knocked off at a good old rate."

This is a problem, Dr Mosley said, because the microbiome plays a role in regulating the immune system. He explained, "The immune system, when you are born, is quite naïve. It kind of doesn't know what level to react at. So it is there to protect you, but it's a bit like a crazy adolescent kid who's going to lash out at absolutely everything.

"What the data suggests is that the microbiome, the gut bacteria, they help to teach the immune system how to behave. And if you don't get that inflammation early in life, then chronic inflammation becomes part of your life, later in life. And that's why we've seen the growth of lots of inflammatory diseases — asthma, eczema, hay fever, you name it. These things are on the rise, and that seems to be to do with the depletion of these bacteria that are supposed to be the educators, and that no longer seem to be doing the task."

Luckily there are ways in which these old friends can be nurtured, according to Dr Mosley. He said caesarean sections and antibiotics should be used sparingly, claiming that children who have been born via caesarean section "tend to have a different microbiome to kids who are born vaginally, and they also have much greater risk of developing obesity and allergic disease later in life". He also suggested altering your diet to include less junk food — "because junk food contains emulsifiers which are pretty bad for the old friends" — and more probiotics and prebiotics.

"Probiotics are basically the seeds, the living bacteria," Dr Mosley said. "Fermented foods — kefir, kombucha, sauerkraut, smelly cheese, yoghurt, and you'll be glad to know that wine is also a fermented food.

"Then there's prebiotics. Prebiotics are basically the food that you feed the bacteria that are already in your gut. So you can basically either swallow them, or you can feed the good ones down there. And prebiotics are things like legumes — they love those — and vegetables of all forms, including onion, leek, garlic, chicory and Jerusalem artichoke. And seaweed is fantastic."

Prebiotics can also be found in food rich in resistant starch, Dr Mosley said — that is, starch which resists digestion and thus functions similarly to fibre. All starchy foods contain resistant starch, but the amount varies greatly depending on how food is manufactured, prepared and cooked. If you're ever cooking pasta or rice, for example, Dr Mosley recommends cooling it and then reheating it — this produces a rise in resistant starch. The same can be said of bread that has been frozen and later reheated, he added.

Overall, Dr Mosley is excited about the recent breakthroughs surrounding the microbiome, inflammation and disease, because it means doctors and scientists have a whole new arsenal at their disposal — one which primarily utilises diet to delay, prevent and even reverse a whole range of seemingly unrelated diseases. And while he admits it will be no mean feat to relay this message to governments, the food industry and society at large, Dr Mosley remains dedicated to his mission to get the word out there, one lecture at a time.



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# Gold Coast Biobank officially opened at Griffith University

Menzies Health Institute Queensland (MHIQ) has established a purposebuilt biostorage facility at Griffith University's Gold Coast campus, in an effort to better bridge the gap between translational research and clinical care.

The Gold Coast Biobank was originally installed at the university back in 2017 but has only now been officially opened. Already it has accumulated over 10,000 biospecimens that are available for research purposes, including over 3000 biospecimens from breast cancer patients and 1500 placenta cord blood specimens.

"Biobank is an important resource where people generously donate samples that allow us to carry out research to find cures for chronic diseases," said Biobank Director Professor Nigel McMillan, with conditions such as breast cancer, heart disease and Alzheimer's set to be investigated through the facility.

"Without this, we wouldn't be able to find cures of the future."

Other services provided by the biobank include:

- storage of biospecimens only (including space only hire or equipment and space hire)
- · biospecimen storage with database hosting
- · database hosting only
- full service ranging from protocol development, specimen collection and processing, to biostorage and database hosting and support.

These services are made possible thanks to next-generation technology housed at the biobank — including an automated biostorage unit known as 'the Arktic', which has the capacity for holding up to 100,000 specimens in a compact package, along with OpenSpecimen, a biostorage management system.

"With this state-of-the-art technology, we have the resources to improve the management of our existing samples and the capacity to take on new projects," Prof McMillan said.

"MHIQ is committed to translating innovative health research into better outcomes and we are able to offer research collaboration for academics and clinicians whose work involves the collection of human tissue."

# Selective antibiotics only target bad bacteria

Inspired by natural products, chemists from the University of Konstanz have developed selective agents that combat infectious diseases while leaving beneficial bacteria alone.

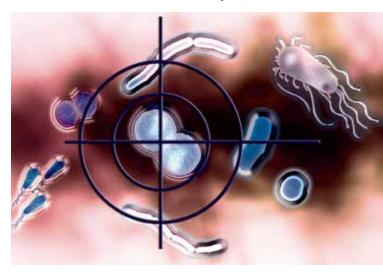
As important as antibiotics are to treat infectious diseases, they are unable to distinguish between pathogens and the beneficial microbes that are vital for human health. Antibiotics can thus destroy the delicate balance of the human microbiome, resulting in permanent damage that could open us up to allergies, weight issues, chronic inflammatory bowel diseases and even psychiatric disorders. But how can we maintain ecological diversity in the case of a microbial infection, where antibiotics remain the best course of action?

Chemist Dr Thomas Böttcher and his team have now made a significant step towards solving this problem, discovering antibiotic properties in a natural product that so far had been considered merely a bacterial signal molecule.

The research team originally studied the signals of the bacterium *Pseudomonas aeruginosa*, which aroused their interest as it was highly selectively inhibiting the growth of *Moraxella catarrhalis* — a pathogen that causes, for example, otitis media in children as well as infections in patients with chronically obstructive pulmonary diseases. The team developed synthetic derivatives of the natural substance, which were found to exhibit antibiotic efficiency against *Moraxella catarrhalis*. Their research was published in *Chemical Science*.

What was really surprising was the substance's selectivity: only the growth of *Moraxella catarrhalis* was inhibited, not that of other bacteria. Even closely related bacteria from the same species remained completely unaffected. Antibiotics with such selectivity would make precision treatment possible and specifically eliminate pathogens while preserving the diversity of beneficial microbes.

In another project, the research team collaborated with Duke University to develop novel, previously undescribed quinolone ring systems to be used against the malaria parasite. This parasite settles in the liver before invading blood cells; the researchers were able to target and eliminate the parasite at this stage of malaria. Their findings, published in the journal *Chemical Communications*, can now be used for targeted research and the development of selective therapies to combat malaria based on new chemical compound classes.



Selective antibiotics enable precision interventions in the microbiome (computer graphic). Image ©University of Konstanz

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# Psoriasis drug could treat rare bone cancer

A treatment for psoriasis could be repurposed to treat a rare but aggressive form of youth cancer, according to a new study led by the Garvan Institute of Medical Research and published in the journal Cancer Discovery.

Osteosarcoma is a rare cancer, but among the 10 most common cancers affecting males between ages 15 to 29, in Australia. Arising in bone, osteosarcoma is often dismissed as growing pain or injury, and in many cases only detected after it has spread to other parts of the body. With no real advances in treatments over the past four decades, the five-year survival rate remains as low as 65%.

"Our search for new potential treatments for osteosarcoma began in 2013 when we investigated genetic risk factors for this form of cancer," said Garvan's Dr Maya Kansara, first author on the study.

"From genome-wide association studies conducted with the US National Institutes of Health we saw that variants in a gene that encodes the protein GRM4 were frequently associated with osteosarcoma.

"In a mouse model of osteosarcoma, we investigated the role of GRM4, as well as a number of immune molecules, the production of which is regulated by GRM4. In our model, we discovered that the inflammatory molecule IL23 was critical to osteosarcoma formation and progression."

When the researchers removed IL23 in mice, they were protected from developing osteosarcomas. When they blocked IL23 in mice with existing osteosarcoma, tumour growth was slowed — and in synergism with doxorubicin, a current standard of care treatment for this form of cancer, tumour growth was even further suppressed. Analysis of human osteosarcoma biopsies confirmed that more than 70% of samples had significantly higher levels of IL23 than non-tumour tissue.

Therapies targeting IL23 have been investigated extensively for a number of autoimmune diseases, including arthritis, intestinal inflammation and the skin condition psoriasis. Drugs that block IL23 are indeed already approved and well tolerated, and on the market now for the treatment of psoriasis, noted Garvan's Professor David Thomas, senior author on the study.

"We are now designing clinical trials to see whether they can provide much-needed improved health outcomes for osteosarcoma patients," Prof Thomas said.

Interestingly, data from a Danish cohort study published in 2017 suggested that patients with psoriasis were almost five times more likely to develop sarcomas than individuals without the skin condition, which "reaffirms the central role IL23 plays in osteosarcoma" according to Dr Kansara. And as the expression of IL23 is higher in multiple cancer types, the researchers believe this may have broader implications for cancer outcomes.





# Vaccine developed to target TB in the lungs

Medical researchers from the Centenary Institute and the University of Sydney have successfully developed and tested a new type of vaccine targeting tuberculosis (TB), said to be the world's top infectious disease killer. Reported in the Journal of Medicinal Chemistry, the early-stage vaccine was shown to provide substantial protection against TB in a preclinical laboratory setting.

There are an estimated two billion individuals carrying TB globally, up to 10% of whom will develop the disease in their lifetime. Co-lead author Dr Anneliese Ashhurst, who is affiliated with both the Centenary Institute and the University of Sydney, described TB as "a huge worldwide health problem ... caused by a bacteria that infects the lungs after it's inhaled, is contagious and results in approximately 1.6 million deaths per year globally".

Following five years of research, Dr Ashhurst and her colleagues have now created an advanced synthetic TB vaccine and demonstrated its effectiveness using mouse models. Dr Ashhurst explained, "Two peptides (small proteins) which are normally found in tuberculosis bacteria were synthesised and then bound extremely tightly to an adjuvant (a stimulant) that was able to kickstart the immune response in the lungs.

"We were then able to show that when this vaccine was inhaled into the lungs, it stimulated the type of T cells known to protect against TB. Importantly, we then demonstrated that this type of vaccine could successfully protect against experimental airborne TB infection."

Professor Warwick Britton, Head of the Centenary Institute Tuberculosis Research Program and co-senior researcher on the project, noted that there is currently only one lone vaccine for TB (known as BCG) and this is only effective in reducing the risk of disease for infants.

"It fails to prevent infection or provide long-term protection in older individuals and it isn't considered suitable for use in individuals with an impaired immune system," Prof Britton said. "More effective vaccines are urgently required to save lives."

Prof Britton is excited that the team's vaccine strategy — directly generating immunity in the lungs — has proven to be the right research approach to take, noting, "The important thing is that the vaccine actually gets to the lungs, because that's where you first see TB.

"Ultimately, we would love to see a form of this vaccine available for use in an easily inhaled nasal spray which would provide lifelong TB protection. Although this outcome is still many years away, we are certainly heading in the right direction. Our next steps will be to determine if our synthetic vaccine can be developed into a form suitable for use in humans."

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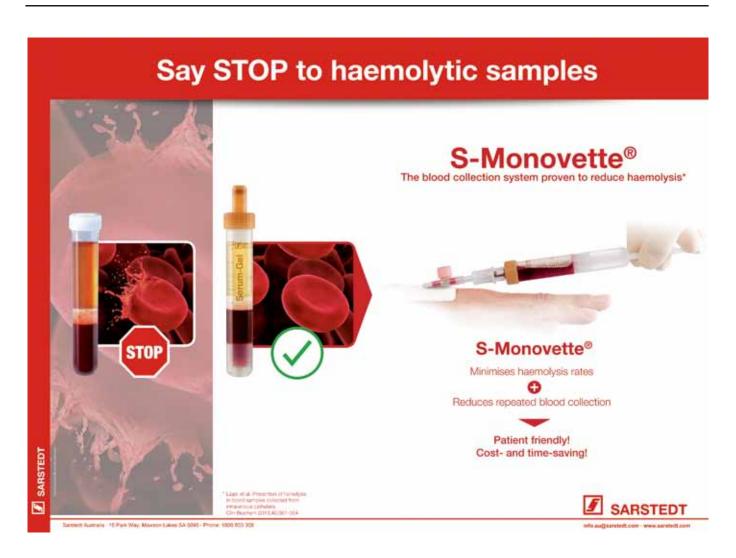
The reduced vacuum pressure in the S-Monovette drastically reduces the rate of haemolysis and vein collapse, meaning increased sample quality and reduced costs associated with repeat collections. Furthermore, unlike pre-evacuated tubes, the S-Monovette does not have to hold a vacuum for many months after manufacture, which allows the membrane stopper to be thinner and more easily penetrated by the needle sheath. This minimises the movement of the needle in the vein when attaching the tube, ensuring optimum patient comfort.

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# No guts, no glory

A series of serendipitous events

The Australian Society for Medical Research (ASMR) is bringing its 2019 National Scientific Conference to Fremantle this November. With a theme of 'Ebbs & Flows: From Discovery to Practice', the conference is set to shine a light on the importance of basic, fundamental science in driving clinical translation and implementation.



ne person who is no stranger to this area is Daniel Drucker — a physician-scientist at the Lunenfeld-Tanenbaum Research Institute at Mount Sinai Hospital, Professor of Medicine at the University of Toronto and speaker at the upcoming ASMR conference. *Lab+Life Scientist* caught up with Prof Drucker about how a series of serendipitous events saw him become a pioneer in gut hormone research.

Prof Drucker's story begins back in the 1980s, when he had recently graduated in medicine from the University of Toronto and had been advised by his mentors to study thyroid hormones at Massachusetts General Hospital. But when he arrived, he was told there was no room in the thyroid project. Instead he would be studying glucagon — a peptide hormone known as an incretin, which stimulates a decrease in blood glucose levels.

"At that time, I was not interested in that field, but I had no other options and just had to get on with it," Prof Drucker said.

"It was probably the most fortunate set of circumstances early on in my career."

It turned out that researchers had recently cloned and sequenced the genes for the precursor of glucagon, known as proglucagon — with surprising results. Prof Drucker recalled, "The gene contained two additional glucagon-like sequences encoding two glucagon-like peptides that subsequently became known as GLP-1 and GLP-2. GLP-1 turned out to increase insulin secretion significantly, so as an endocrinologist, I quickly realised that this nascent field in which I found myself had enormous potential."

In 1987, after returning to the University of Toronto as an Assistant Professor of Medicine, Prof Drucker and his colleagues began studying how GLP-1 works on appetite and energy balance, and what happens to GLP-1 action during the development of diabetes and obesity. They found

that, in addition to stimulating insulin, the hormone also played a role in controlling motility, appetite and body weight.

The researchers realised the potential of regulating GLP-1 and related peptide activity, but the use of natural GLP-1 in therapy was problematic. It is not very stable, it is degraded quickly by other enzymes, and it rapidly clears in the body — which is a problem for any patients who are relying on a steady supply of the hormone.

More than a decade later, researcher John Eng, working at the James J. Peters VA Medical Center, was analysing the venom of the Gila monster — a poisonous lizard that lives in the southwestern United States. When Eng examined the venom to determine which hormones were present, he discovered a new hormone — known as exendin-4 — which turned out to be very similar to the human hormone GLP-1.

"The big difference was that exendin-4 is much more stable, and this was an important breakthrough in GLP-1 therapy," Prof Drucker



said. "The pharmaceutical industry later tested and further developed synthetic exendin-4 into the drug known as exenatide."

Further surprises came when the US FDA requested that all new diabetes drugs had to demonstrate cardiovascular safety, which led to a lengthy examination of GLP-1's effect on blood pressure, blood flow and more. Prof Drucker revealed, "It turned out that activating the receptor for GLP-1 strongly protects the heart.

"Although many of the new GLP-1-based medicines were known to be effective in reducing blood glucose or body weight, the positive cardiovascular effect, evident in large human trials, has surprised us all. The medicines reduce the number of heart attacks and strokes and decrease cardiovascular death."

But what of the gut peptide cousin of GLP-1, GLP-2? This was originally observed by Prof Drucker in 1995, while developing a new cell line for studying glucagon-like peptides. To study GLP-1 secretions, he and his colleagues created

small tumours in mice that could overproduce the gut hormones.

"We noticed that the intestines of the mice with these glucagon-producing tumours were very large, and we got very excited," Prof Drucker said. "We said maybe the tumours are making something that stimulates intestinal growth."

GLP-2 was found to be a strong growth factor that works specifically in the intestine, which Prof Drucker thought might be able to help those with short-bowel syndrome — a condition in which people's small intestines are so short that they have difficulty in absorbing fluids and food. Many people with this condition need hours of life-sustaining intravenous infusions every day and have difficulty in living a normal life, experiencing constant diarrhoea, malnutrition, weight loss, fatty liver and more.

"We examined the effect of GLP-2, first in animals and later studies were done in humans, and found that it can restore enough functional intestine to make a difference," Prof Drucker said. "With the help of a local biotechnology company, we managed to develop this into a therapy so that, today, people with short-bowel syndrome only need to inject it once a day.

"By treating patients with GLP-2, their fatty liver reversed and some of them could even lead normal lives without needing intravenous nutrition. And it was all because of a serendipitous observation that we pursued."

Prof Drucker's research interests converged in the late 1990s when he turned his focus to DPP-4 — an enzyme that was found to degrade incretin hormones. DPP-4 turned out to have a very close connection to incretins — and Prof Drucker's group, working with DPP-4 knockout mice and DPP-4 inhibitors, were keen to understand how the enzyme worked.

"DPP-4 was shown to be a key regulator of GIP, GLP-1 and GLP-2 by cleaving and inactivating these hormones," Prof Drucker said. "We and other colleagues quickly identified DPP-4 as a key to controlling the degradation of gut incretin hormones responsible for glucose control."

By inhibiting DPP-4, the researchers could enhance the effect of incretins: for example, potentiating GLP-1 and GIP activity in people with type 2 diabetes. However, DPP-4 has a much more complex biology beyond glucose control and has signalling functions at many sites in the body, Prof Drucker revealed — including within the immune system. It therefore acts as a key link between the immune system, inflammation in the

body and diseases such as obesity, type 2 diabetes and cardiovascular diseases.

"GLP-1 reduces inflammation. DPP-4 controls inflammation. GLP-2 reduces intestinal and systemic inflammation. So all of a sudden, the major themes of our research have converged on inflammation," Prof Drucker said.

"Our most recent studies have shown that DPP-4 inhibitors can upregulate soluble DPP-4 and potentially modify inflammation in many types of tissues. This finding may prove to have many important clinical implications, and we hope to understand the importance of this finding in animals and humans."

For these and other contributions to gut hormone research, Prof Drucker was recently presented with the 2019 EASD-Novo Nordisk Foundation Diabetes Prize for Excellence — an initiative of the European Association for the Study of Diabetes (EASD) and the Novo Nordisk Foundation. The prize, which is accompanied by DKK 6 million (around \$1.3 million), is awarded for outstanding research or technology contributions that increase knowledge of diabetes, its disease mechanisms or its complications. The prize committee unanimously made the decision to award this year's prize to Prof Drucker, with EASD President Professor David R Matthews calling him an "extremely worthy and deserving recipient".

Now Prof Drucker is bringing his expertise Down Under, delivering the Firkin Oration on the second day of the ASMR conference — and he hopes to make the oration "of broad interest to all who attend".

"I will give an overview of our bench-tobedside science in peptide hormones, diabetes, obesity, intestinal and cardiovascular biology, highlighting our own scientific stories mixed with new data," he said.

The 58th ASMR National Scientific Conference 2019 will be held in the WA Maritime Museum, Fremantle, from 20–21 November.

For more information and to register, visit https://asmr.org.au/asmr-nsc/.



Professor Daniel Drucker.

# Process controls save time and space in pharma plant

Creating a pharmaceutical manufacturing suite is a complex task that is governed by a host of standards and specifications. For the AstraZeneca manufacturing plant in Sydney, the decision to change its primary supplier of process control valves to Bürkert reduced installation and commissioning costs while also improving process data availability.

The aim of the expansion was to fully automate and modernise the production process as well as increase efficiency and safety — while also meeting strict pharmaceutical standards. The project involved three solution preparation suites where the active ingredient is combined with WFI and other ingredients to create a batch of medication. Once the batch has been discharged from the storage containers, either CIP or SIP processes are used to clean the production pipework and vessels, ready for the next batch.

Ryan Orbell, National Segment Manager – Hygienic for Bürkert in Australia, explained: "The project was already specified and quoted when we became aware of it; however, I knew Bürkert could offer improved functionality and save on installation time compared to the products that had been specified. I contacted the project team at AstraZeneca to explain how Bürkert could deliver a more effective solution."

Orbell explained about the benefits of a decentralised control solution using Bürkert's intelligent automated valve control heads with a fieldbus communication network. The aim was to introduce a decentralised control structure, which would not require the use of pneumatic valve islands. This system format would minimise wiring, installation and commissioning costs while providing

more information about the manufacturing process itself.

One of the attractive points for AstraZeneca was the ultrabright LED optical lighting on the valve control heads, which offers operators a clear visual status indication at a glance. The engineering team asked if the colour sequence could be changed to match theirs, and so Bürkert put a request to the Systemhaus design team in Germany. Within a week, a new bespoke printed circuit board had been created and released as an AstraZeneca-specific option for the control heads, meaning that any valves ordered in the future with this option would provide status signals that matched the rest of the production facility. Furthermore, while some valves with long lead times had already been ordered from another manufacturer, Bürkert control heads are designed so that they can be retrofitted to other valve bodies.

One of the project criteria was to reduce the number of welded joints and minimise the dead space in the system. Bürkert was able to design and manufacture a number of specialty distribution valve blocks that achieved this while matching all other hygiene standards applied to the rest of the installation. There was also a requirement to minimise the space occupied by the production suite, and Bürkert's Robolux Valve proved a suitable solution; it enables two independent valve seats switching functions to be achieved within the one membrane. This reduces the installation space requirement, eliminates T-adapters and halves the total number of membranes, actuators and control heads required per seat.

An additional benefit of the Bürkert equipment was compatibility with the existing Profinet communications protocols in the AstraZeneca plant. Available with several communications alternatives, selecting the ASi interface option for the control heads ensured integration with the Siemens PLCs used throughout the site. In the final analysis, AstraZeneca decided to opt for all Bürkert equipment, the one exception being a valve body that had already been welded to the base of process tanks. These were fitted with Bürkert control heads, diaphragms and actuators so that all the valves in the new process area would have the same control components.

"Bürkert has since gone on to supply other projects on the site, including a WFI suite, purified steam processes, nitrogen supply and a sterile compressed air project," Orbell said. "Our products are now the standard across the solution preparation suites and to all services and utilities applications across the site. In each case, our experienced engineers have offered a combination of standard and bespoke products that work together to deliver the most efficient and reliable hygienic process systems."

In partnering with Bürkert, AstraZeneca now has six suites either in full operation or in construction. The company also has completely automated processes for the WFI water purification production plant, with clean steam, clean compressed air and nitrogen. The partnership has ensured that every step of the upgrade met hygiene requirements and achieved pharmaceutical manufacturing facility standards, while helping AstraZeneca meet growing demand for its products.

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#### Automated high content imaging system

The CELENA X High Content Imaging System is an imaging tool designed for rapid, high content image acquisition and quantitative analysis.

The fully integrated system with onstage incubator allows users to quickly and easily set up high content imaging experiments to measure phenotypes of interest objectively, quantitatively and reproducibly within a precisely controlled environment. Capabilities extend from the simplest fixed cell assays to more complicated, time-lapse live cell assays, making it suitable for high content analysis for life science research as well as drug discovery and development.

With four-channel fluorescence, brightfield, colour brightfield and phase contrast imaging modes, together with laser autofocusing and motorised positioning of the XYZ stage, the CE-LENA X is designed to ensure rapid, reproducible and clear images every time. Interchangeable objectives and hard-coated LED fluorescence filters accommodate a wide range of fixed and live cell imaging applications. Some of these include apoptosis, autophagy, proliferation and migration, as well as studies of cytotoxicity of drugs, cell viability and transfection efficiency.

Image analysis can involve differentiation of multiple phenotypes, determination of the morphology of individual cells and organelles and defining the spatial distribution of targets. Multiple measurements can be made for each cell.

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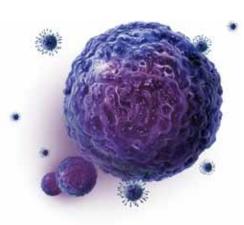
# Premade labelled cancer cell lines

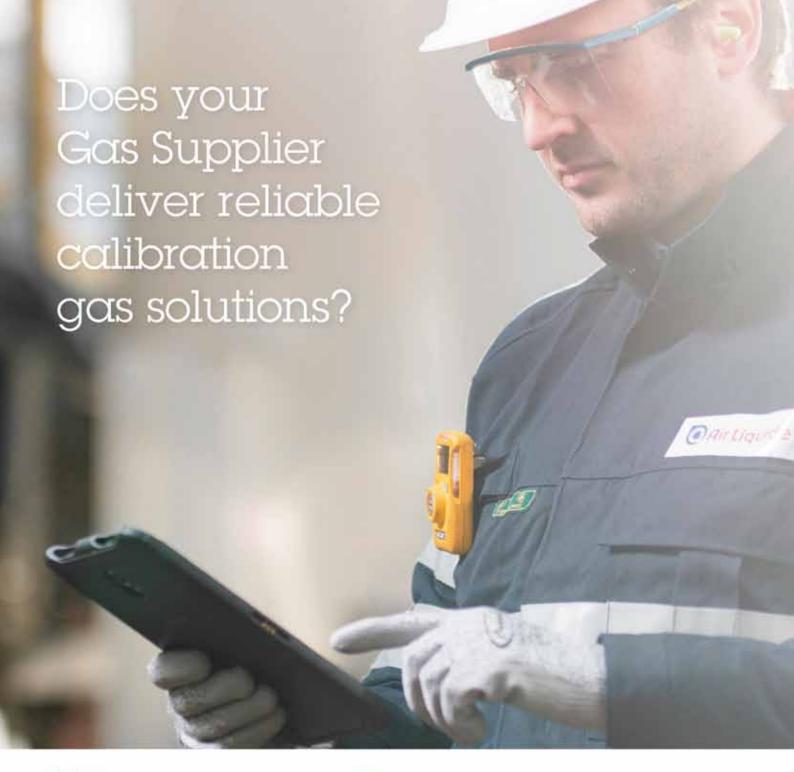
In vivo monitoring of tumour growth and metastasis provides a powerful means for studying cancer properties and the development of effective therapies. Mouse models created with tumour xenografts have long been used for such purposes; however, without a convenient means to visualise cancer progression in these animals, invasive surgical procedures are required in order to estimate the size and weight of primary and metastatic tumours, and cannot be used for early stages in tumour development.

GeneCopoeia's premade labelled cancer cell lines are either dual-labelled with luciferase and GFP or single-labelled with GFP. Robust luciferase expression permits sensitive, non-invasive detection of cancer cell growth and progression in vivo, beginning soon after injection. In addition, GFP expression is useful for in vivo tumour monitoring without the need for substrate perfusion, or for in vitro visualisation and immunocytochemistry.

Users can choose from among 34 premade lines with dual labels or 12 for the single label; tumour types include breast, liver, pancreas and colon. Applications include the study of tumour cell properties using biochemical and genetic methods in vitro and to monitor tumour growth, progression and metastasis in vivo in response to a variety of environmental stimuli, drugs and other therapeutic treatments.

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# How cloud computing is transforming the life sciences

Life sciences cover a diverse set of fields, ranging from biomedical devices and pharmaceuticals all the way to life systems technologies and nutraceuticals.

hese fields, and the explosion of advancements that are encompassed within them, have been instrumental to the constant and safe advancement of humanity. Biomedicine, for example, is a cornerstone of modern health care and has brought forth numerous recognised accomplishments, such as the mapping of the human genome. Work in these fields, however, is never done; for instance, smallpox. While the World Health Organization officially declared the devastating disease eradicated in 1980, essential research continues to this day to ensure the world remains free of this deadly virus.

Clearly, any data that is being produced from research within these fields is of great importance to humanity. In fact, for many people it is quite literally life-changing. While striving to remain on the cutting edge of scientific discovery, researchers need more agile and powerful computing in order to drive towards a better future for everyone. And, equally important, their research and data need to be easily accessible yet securely protected. Our future, after all, could depend on it.

#### It's all about the data

The requirements of researchers involved in the study of life sciences are unique. Teams and individuals working around the globe need to access huge amounts of data easily, efficiently and on-demand. Any uploaded data must be processed in real time or near-real time, and in large amounts, by high-volume compute power.

Having access to larger data volumes gives scientists the ability to investigate and process more essential data and increases the possibility for quicker results, deeper insights and, ultimately, the potential for new life-altering and life-saving discoveries.

Critically, the important data that is being generated through this research needs to be managed, protected and secured.

# Mission-critical research calls for mission-critical clouds

The complex, mission-critical needs noted above are the exact reason why a mission-critical cloud platform can play such a huge role in transforming life sciences.

Enterprise-class cloud computing offers adopters the ability to run extremely large datasets, perform complex calculations and access data in real time from anywhere on the planet with a connection. It also offers remote access to users and drives virtual collaboration, which empowers teams that may be distant from each other to work together and leverage each other's insights in ways

that are not available with traditional on-premises computer infrastructure and working models.

It's important to remember that the research and data being stored is often sensitive, regulated and/or proprietary. Mission-critical cloud offerings like the Virtustream Enterprise Cloud platform can provide the required levels of integrated security, including related services and certifications, and product features such as encrypted data at rest, in use and in motion, without negatively effecting I/O performance. Securing and protecting information in the cloud can give researchers and businesses peace of mind.

Enterprise-class clouds should also provide disaster recovery solutions in the form of data replication at dispersed data centres, and RPO and RTO capabilities, data backup and recovery options. Finally, top-tier cloud platforms also conform to local and international compliance requirements.

#### Innovation and inspiration

When researchers can trust their data and research in the cloud, they are free to drive new innovations in their fields of study across the life sciences. Having access to the larger data volumes facilitated by cloud computing gives life scientists the ability to investigate and process more essential data, increasing the possibility of faster advancements and new discoveries. Cloud solutions also encourage real-time coordination between partners and facilities worldwide, breaking down time zones and encouraging greater collaboration.

Organisations also can introduce data orchestration solutions, such as SAP Data Hub, into their cloud environment, enabling them to better organise, distribute, share, subset and manage their critical data while achieving a better return on their big data initiatives and investments.

SAP data management and archiving solutions can also be leveraged alongside a cloud deployment to reduce storage and memory costs, alleviate performance constraints associated with sizing and ensure that all data adheres to compliance and regulatory data requirements.

By innovating in the cloud, researchers can achieve better productivity, ultimately resulting in more time and resources being available to further investigate the big issues facing the world today.

#### The future

It is believed that in the next 3–5 years the majority of pharmaceutical research activities will transition to the cloud, and the reasoning is clear. Cloud computing delivers cost savings associated with leaving traditional software and IT infrastructure behind, increased agility, quicker response times to compliance and legal requirements, easier scalability of computing power and storage capacity and more.

Alongside this, the cloud can provide worldclass availability and resiliency, data protection and recovery, and security and compliance.

In short, cloud computing can have a massive impact on the life sciences. It can empower organisations, teams and individuals to examine larger datasets in search of previously undetected patterns and correlations and enables quicker and easier sharing, while also streamlining how a company stores and manages its data within a highly secure environment. In essence, cloud-based IT becomes a critical innovation lever itself within the super-charged engines of life sciences research.

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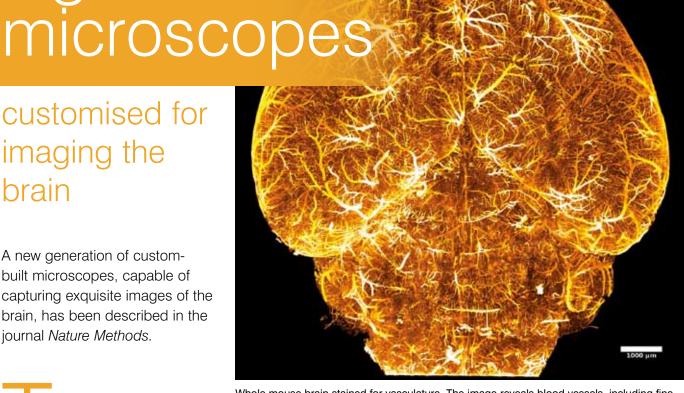
Light-sheet

A new generation of custombuilt microscopes, capable of capturing exquisite images of the brain, has been described in the journal Nature Methods.

he devices, known as mesoSPIMs (mesoscale selective plane-illumination microscopes), are light-sheet microscopes that optically 'slice' samples with a sheet of light unlike traditional microscopy, in which specimens are sliced with a blade. This optical sectioning captures slivers of image without damaging the sample. The imaged slices are then combined to reconstruct a detailed three-dimensional image of a whole organ or specimen.

However, the datasets produced by standard light-sheet microscopes are very large and analysing them is time-consuming. MesoSPIMs get around this problem with innovative optical technologies that allow fast scanning as well as direct visualisation and quantification of the captured data. By creating high-resolution images of large samples faster than existing microscopes, mesoSPIMs are thus beneficial for rapidly screening many samples.

MesoSPIMs are capable of imaging the minute detail of brain tissue down to individual neurons that are five times thinner than a human hair, and can uncover the 3D anatomy of entire small organs. They can be used to provide new insights into brain and spinal cord organisation for researchers



Whole mouse brain stained for vasculature. The image reveals blood vessels, including fine capillaries. Image credit: mesoSPIM.org.

working to restore movement after paralysis or to investigate neuronal networks involved in cognition, pleasure or drug addiction.



This large-scale dataset reveals the developing nervous system of a sevenday old chicken embryo captured with a mesoSPIM microscope. Image credit: mesoSPIM.org.

A new open-source initiative, comprising top European researchers in neuroscience, is now driving dissemination of mesoSPIMs globally by sharing their expertise and excitement as well as images and videos. The mesoSPIM Initiative, started by Dr Fabian Voigt at the University of Zurich, enables the integration of cutting-edge technologies into research labs worldwide, allowing microscope development and brain research to flourish.

"We created the open-source mesoSPIM Initiative to share the latest developments in microscope instrumentation and software with the imaging community," said Dr Voigt. "Anyone seeking high-quality anatomical data from large samples now has the information they need to build and operate their own mesoSPIM."

The initiative is aimed at research groups and imaging facilities with experience in building and supporting custom microscopes. A mesoSPIM can be installed in a few days and typically requires a budget of around \$200K. There are currently seven mesoSPIMs in operation across Europe and several more instruments under construction.

For more information about the mesoSPIM Initiative, visit http://mesospim.org.

#### Pathogen detection system

The 3M Molecular Detection System is designed to help save time and labour with its ready-to-use reagents, a single protocol for all pathogens and same- or next-day results. With its space-saving design and ability to test for multiple types of pathogens simultaneously, it should help users increase productivity and release products quickly, protecting consumers and businesses.

Easy to learn, use and implement, the system features a compact design that fits into any lab, tests up to 96 samples per run for high throughput and can run all assays simultaneously for high productivity. Ready-to-use reagents minimise the chance for error, a colour-change process control offers confidence in the results and a streamlined workflow is said to reduce technician time by 30%.

Using isothermal DNA amplification and bioluminescence detection, the 3M Molecular Detection Assays can detect as low as 1 CFU of target pathogen per sample. Assays now include *Salmonella*, *Listeria*, *Listeria* monocytogenes, *E. coli* O157 (including H7), *Cronobacter* and *Campylobacter*.

3M Food Safety www.3m.com.au

#### Microplate washer

BioTek Instruments has added further capabilities to its 405 TS microplate washer, designed to improve laboratory workflows, simplify the user experience, and provide more time-saving convenience and value for applications such as cell-based assays, ELISAs, bead washing and more.

Updated software allows the user to define a specific volume to remain in the wells after aspiration and a fully adjustable regulator enables fine-tuning of the vacuum pressure, protecting fragile cell layers and spheroids from disruption. Once created via the user-friendly touch-screen interface, protocols may be password-protected to prevent unauthorised or accidental changes, and quickly recalled for use. When integrated with BioTek's BioStack Microplate Stacker, the washer displays the plate number in process and the remaining overall processing time for all plates in the stack.

The updates add to existing 405 TS features that are designed to enable laboratories to operate more efficiently, including Verify technology to identify manifold tube blockages and report suspected clogs and Ultrasonic Advantage for thorough, automated and hands-free manifold cleaning.

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Laboratories are complex environments to work in, so staff are inevitably exposed to a range of chemicals in their daily work. Training, PPE, procedures, ventilation systems and modern equipment are all focused on reducing chemical exposure; however, all of these systems need to be working 'as-designed' to provide effective protection. Similarly, some of these systems may work against each other, resulting in lower effectiveness.

BioSafety's highly trained staff of scientists, hygienists, chemists and microbiologists are experienced in working in controlled environments. They bring timely and valuable assessments and recommendations to situations of compromised air quality and surface contamination in laboratories, assessing measurable parameters to find if all systems are working to provide a safe environment. Handheld specific chemical



monitors, air sampling badges, IAQ measurements, ventilation exchange rates, fume cupboard and extraction flow rates, microbiological contamination and radio-isotope assessment can be used to gain a holistic view of the controlled environment.

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#### Desktop electron microscopes for biomedical research

Scanning electron microscopy (SEM) is a valuable tool that can be used to investigate a wide range of materials for their structure and composition. When used in biomedical research, SEM images can help gain further insights to describe tissue or organ structures and to enhance scientists' understanding about certain diseases. To meet the ever-growing needs of different types of users and labs, there is a wide array of SEMs available.

While traditional SEMs remain relatively large and difficult to operate, Thermo Scientific Phenom desktop SEMs are designed to be smaller, faster and easier to use. From sample loading to imaging, the Phenom ProX offers fast time to image (<30 s) with a magnification range up to 150,000x and fully integrated detectors (BSD, SED and EDS for elemental composition). The Phenom XL desktop SEM goes further to allow operators to quickly examine many samples or different spots within one large object. This is achieved using the sample holder, which is able to accommodate up to 36 small specimens on stubs or one single large object with a maximum size of 100 cm<sup>2</sup>.

Building on the performance of these models, the Phenom Pharos desktop SEM has a field emission (FEG) source that is able to deliver magnifications of up to one million times. It delivers higher resolution images in the same compact design of the Phenom SEM series, while maintaining the same easy and intuitive operation. Energy dispersive X-ray spectroscopy (EDS) can be added to analyse the elemental composition of samples.

ATA Scientific aims to make SEM accessible to everyone, providing users with all the information needed to invest in the appropriate tool for their application.

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#### High-precision Kjeldahl analysis system

C. Gerhardt's VAPODEST 500 is suitable for all established methods of Kjeldahl determination and for distillation methods for the determination of ammonium, nitrate or TVBN. The system is designed for high sample throughput and unattended operation. It can be used with variable tube sizes.

The product offers fully controlled automation and management of the distillation and titration process. Calibration and a daily routine are easy to manage, with more than 32 preconfigured methods — users can select a standard method or modify the method according to their requirements.

The system is steam power-adjustable from 1 to 100% and features the automatic addition of H<sub>3</sub>BO<sub>3</sub>, H<sub>2</sub>O and NaOH. It has a full-colour 7" touch screen and a safety transparent door that protects the user and makes the distillation process visible. Simultaneous distillation and titration accelerates the entire process.

Suitable balances can be connected to the VAPODEST, allowing for the tracking of samples from weighing to titration — sample ID/volume/weight is automatically transferred. The system fully conforms to DIN EN ISO, AOAC, EPA, ASTM, EC regulation, APHA, and Ph. Eur. 2.5.33 method 7, procedure A.

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A research team led by the University of Warwick has developed a powerful method of analysing chemical mixtures that has been able to assign 244,779 molecular compositions within a single sample of petroleum — said to be a world record.

ssigning the compositions of molecules in a complex mixture is a valuable tool for a number of industries, where the elemental composition of those molecules can provide valuable data for research, determine the mixture's viability such as in the petrochemical industry or even 'fingerprint' a complex mixture such as oil or environmental samples. The Warwick researchers developed a method called operation at constant ultrahigh resolution (OCULAR), which combines experimental and data processing techniques that allowed them to characterise the most complex sample that they have ever worked on.

Using Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS), the researchers analysed a sample of heavy petroleum in solution. The molecules in the sample were then ionised, excited and detected to determine the mass-to-charge ratios using a solariX (Bruker Daltonics) FT-ICR mass spectrometer at the University of Warwick. The ultrahigh resolving power and mass accuracy of FT-ICR MS allows the scientists to determine the elemental compositions within even the most complex samples, with a high degree of confidence.

Traditional analysis performed with a variety of Fourier transform mass spectrometers (FTMSs) offers decreasing resolving power and confidence in assignments of the elemental compositions at higher m/z when studying a broad m/z range.

With the OCULAR method, ions are analysed using smaller data segments based on their mass, where the experiment is designed in a way to ensure almost constant resolving power across the full mass range analysed. In an example published by the researchers in the journal *Chemical Science*, a constant resolving power of 3 million was used to characterise a heavy petroleum sample.

Using an algorithm developed by the researchers, the segmented data can be automatically prepared and 'stitched' together to generate a complete mass spectrum (relative abundance vs m/z). Each peak represents a single molecular composition, and so the entirety of the mass spectrum covers the compositional space of the sample. This allowed them to operate at much higher resolution and also addressed issues relating to space-charge effects, where a large number of ions will affect the accuracy of the mass measurement. The result was resolution, detection and assignment of the highest number of peaks within a sample to date, the researchers said.

The technique can be used for any analysis of a complex mixture and has potential applications in areas such energy (eg, petroleum and biofuels), life sciences and health care (eg, proteomics, cancer research, and metabolomics), materials (eg, polymers) and environmental analysis, including being used to fingerprint oil spills by their molecular composition.

"This method can improve the performance of a range of FTMS instruments, including high and low magnetic field FT-ICR MS instruments and Orbitrap instruments," said lead author Dr Diana Palacio Lozano, from Warwick's Department of Chemistry. "We are now able to analyse mixtures that, due to their complexity, are challenging even for the most powerful analytical techniques. This technique is flexible as the performance can be selected according to the research needs."

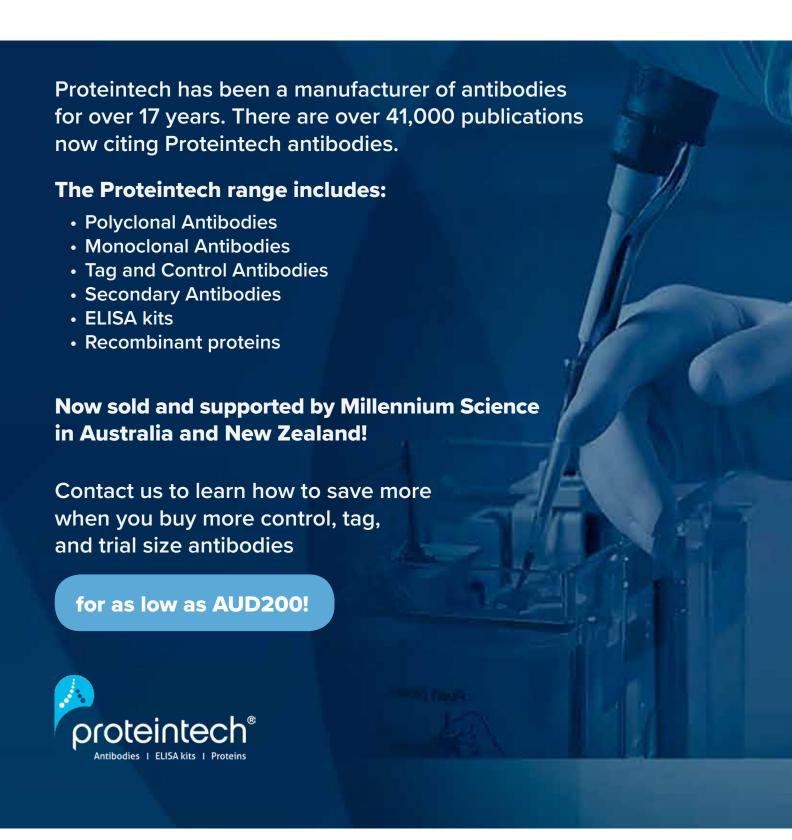
Petroleum samples are inherently highly complex and so were an ideal test for this method. As the world's use of petroleum spurs the move to heavier oils, the samples are becoming more complex and so there is also a greater need for this type of analysis by petrochemical scientists.

The low volatility of the heavier oil can now be explained by the extraordinarily complex elemental composition. The high complexity of heavy oils can interfere with catalysis and affects extraction, transport and refining processes. The OCULAR technique is also powerful enough to be used on samples that require the highest performance to assign compositions based on mass accuracy or fine isotopic patterns.

"The OCULAR approach allows us to push the current analytical limits for characterising the most complex samples," said principal investigator Dr Mark Barrow. "It significantly extends the performance of all FTMS instruments at no additional cost and works well with developments in the field, such as newer hardware designs, detection methods and data processing methods. OCULAR is highly versatile, the experiments and processing can be adapted as needed and the approach can be applied to many research areas, including energy, health care and the environment."

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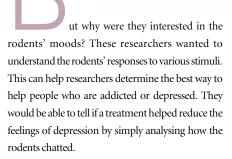




Deep learning deciphers

what rats are saying

For many years, researchers knew that rodents' squeaks told a lot about how the animals are feeling. Much like a wagging tail on a dog, certain vocalisations indicate the rodents are happy, while others indicate the rodents are stressed, or even depressed.



Rat chatter is difficult to decode since rodents communicate largely in ultrasonic vocalisations (USVs) that human ears cannot hear. USVs range from 20 to 115 kHz, while humans can typically hear sounds from 20 Hz to 20 kHz.

Up until now, researchers have relied heavily on time-consuming, manual analysis of rodent chatter. The vocalisations are at such a high frequency, researchers had to slow down the recordings in order to hear them. Even with specialised microphones, tagging and categorising the high-pitched squeaks in recordings is labour intensive. These methods are also vulnerable to human error and misinterpretation.

"In the past, researchers have recorded these to gain better insights into the emotional state of an animal during behaviour testing," said Professor John Neumaier, from the Department of Psychiatry & Behavioural Sciences at the University of Washington (UW). "The problem was that manual analysis of these recordings could take 10 times longer to listen to when slowed down to frequencies that humans can hear. This made the workload exhaustive and discouraged

researchers from using this natural read-out about animals' emotional states."

Prof Neumaier turned to artificial intelligence (AI) to automate the process, working with UW postdoctoral fellow Dr Kevin Coffey and Russell Marx, a technician in the Psychiatry & Behavioural Sciences, to create DeepSqueak — deep learning software that detects and analyses USVs. Their research was recently published in *Nature* journal *Neuropsychopharmacology*.

"We can train the software to analyse these calls in a way that is much more similar to how humans learn," said Dr Coffey. "Rather than mathematically describing what a vocalisation is, we just show it pictures and examples."

DeepSqueak works by turning an audio problem into a visual problem. The input to DeepSqueak is an audio file (.WAV or .FLAC). DeepSqueak splits the audio files into short segments and then converts these segments into images (sonograms).

The sonograms are fed into a deep learning AI program that identifies and classifies the images, much like the AI used in self-driving cars to identify stop signs and lane markers. It first decides if a squeak is present in the sonogram and, if so, what type of squeak it is.

"DeepSqueak uses biomimetic algorithms that learn to isolate vocalisations by being given labelled examples of vocalisations and noise," Marx said. The team started DeepSqueak using example code, Object Detection Using Faster R-CNN Deep Learning, from the MathWorks website. From there, they developed the DeepSqueak software package and GUI in MATLAB. DeepSqueak uses Computer Vision System Toolbox, Curve Fitting Toolbox, Image Processing Toolbox, Parallel Computing Toolbox and Deep Learning Toolbox.

The team found that the rodents are happiest when anticipating a reward, such as sugar, or playing with their peers. They also found male rodents behaved differently when female rodents were around.

Prof Neumaier said his goal is to develop treatments for stress disorders and addiction. DeepSqueak will help the lab get there much faster by making deciphering ultrasonic vocalisations convenient and quick.

"If scientists can understand better how drugs change brain activity to cause pleasure or unpleasant feelings, we could devise better treatments for addiction," he said.

The team has made DeepSqueak available to all researchers so they can create their own analysis. The program can currently identify approximately 20 different USVs; the team hopes that as others identify and tag various USVs, they'll be able to create a virtual Google Translate for rat chatter. The code is available at https://github.com/DrCoffey/DeepSqueak.

MathWorks Australia au.mathworks.com



vibrations by generating a counterforce.

Ever since high-resolution measurements and manufacturing techniques have reached nanometre scales, vibrations have become a major problem. Typical sources of disturbing vibrations can be building and floor vibrations, acoustic vibrations, and motorised equipment and machinery. Effective elimination of disturbing vibrations can thus be the key to precise and repeatable results.

Accurion's approach is to isolate the application from a vibration source. It is useful for confocal microscopy, digital holography, ellipsometry, fluorescence microscopy, inverted microscopy, Langmuir-Blodgett trough, laser scanning microscopy, nanoindentation, optical 3D measurement, patch clamping, profilometry, Raman microscopy, scanning electron microscopy, scanning probe microscopy, spectrometry and tensiometry.

Various products are available, ranging from compact high-performance isolators for small to mid-size applications — such as the i4 series and nano series — to ergonomic laboratory tables with integrated active isolation systems, such as the workstation and IVF series. Acoustic enclosures, heavy load isolation solutions and custom design solutions are also available.

SciTech Pty Ltd www.scitech.com.au

#### 25 mL conical tubes

The latest member of the big Eppendorf tube family fills the gap between the volumes of traditional conical tubes of 15 and 50 mL. Optimised height, quality and specifications make the Eppendorf Conical Tubes 25 mL suitable for cell biology, eg, for pooling media from T75 flasks, bacteria culture in midi prep size or overlapping applications like buffer preparation, storage and transport.

The lower tube height is designed not only to allow for safer pipetting to reduce contamination during liquid handling, but also to require about 20% less storage space.

Samples are available now with both patented SnapTec cap and screw cap options.

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#### **FIB-SEM solution**

The TESCAN AMBER X is a FIB-SEM solution that combines high-throughput plasma-assisted ion milling with ultrahigh-resolution (UHR) field-free SEM optics — a combination suited to materials characterisation over a wide sample range. The product targets applications include milling and characterisation of large cross-sections (up to 1 mm in width), multiscale, multimodal FIB-SEM tomography, and contamination-free preparation of micro- and nano-structures for subsequent testing or characterisation.

Whereas the more common gallium FIB-SEM systems, such as TESCAN AMBER or SOLARIS, are suitable for applications that require high ion beam milling precision, their versatility for multiscale characterisa-

tion and sample preparation of novel materials can be compromised by their limited milling speed and liquid metal ion contamination artefacts. TESCAN AMBER X is thus useful for materials laboratories that require multiscale characterisation over a wide range of traditional and novel materials.

Xenon plasma FIB differs from gallium liquid metal ion FIB technology with its ability to focus more ions into the beam, thereby achieving higher ion beam currents than what is possible with liquid metal ion species. The benefit of higher ion beam currents, up to 1 uA for TESCAN AMBER X's high-resolution plasma FIB configuration, is their higher milling rates — said to be one order of magnitude and more — while also delivering fine milling and polishing capabilities with 15 nm optical resolution. Due to the inert nature of xenon, plasma FIB eliminates any risk of sample contamination by ion implantation.

The product's field-free BrightBeam electron column extends ultrahigh resolution for concurrent SEM, EDS or EBSD characterisation to a wide range of materials, like metallic, magnetic, non-conductive or beam-sensitive, that might otherwise be affected by non-field-free electron optics, while still achieving ultrahigh resolution (1.5 nm @ 1 kV).

AXT Pty Ltd www.axt.com.au



Rocker MF series magnetic filter holders with double-layer magnets are designed to ensure a tight seal between the funnel and support base. The user-friendly design allows one-handed operation and prevents possible twisting and tearing of the membrane.



The innovative design of a detachable hose fitting on the support base allows direct connection to vacuum source, while the base design allows it to be used with various kinds of vacuum flasks and bottles with or without a side arm. Positioning and handling of the filter membrane are also made easy with the membrane guide and forceps access points.

Constructed of polyethersulfone (PES) material, the MF series filter holders are resistant to a wide range of solvents, sturdy and autoclavable.

Labtek

www.labtek.com.au



#### Pinpoint cell penetrator

The MICRO-ePORE pinpoint cell penetrator from WPI is a simple and versatile system that can be used for efficient microinjection of a diverse array of components and biomolecules into oocytes and pre-implantation stage mammalian embryos. Flutter Electro Technology (patent pending) assists in small, clean, precise membrane penetration without tearing or damaging the membrane.

The cell penetrator offers a solution for microinjection resulting in high viability. The instrument creates an oscillating electric field at a localised site on the membrane immediately beneath the site of injection. This creates small, reversible holes in the plasma membrane through which material is microinjected. The research determines the amplitude and frequency of the signal that best suits the application. The result is that the membrane does not tear and thus allows for superior viability of embryos, according to the company.

The MICRO-ePORE cell penetrator has been successfully tested in mouse and primate pre-implantation embryos, as well as gene silencing in zebrafish.

Coherent Scientific Pty Ltd www.coherent.com.au











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#### LIMS

Laboratories are increasingly required to manage large volumes of data to strict standards, while evolving to improve efficiency, automation and



turnaround times. Autoscribe Informatics' Matrix Gemini LIMS (laboratory information management system) is designed to be flexible enough to meet these challenging needs.

One of the main features of Matrix is the configuration tools designed to efficiently create optimised yet adaptable workflows with no custom coding. These tools provide flexibility, resulting in faster implementation times, a longer system life and a reduced cost of ownership, according to the company.

Matrix Gemini LIMS can be found in laboratories around the world, from pharmaceuticals to the food and beverage industry, veterinary and mining. As the LIMS has been used in so many different industries, many standard configurations are available that can be quickly adapted for individual users, using the Matrix configuration tools.

Matrix offers ease of use and flexibility, allowing adaption as the user's needs evolve. The local sales and implementation team in Australia ensures prompt assistance as required.

Autoscribe Informatics Pty Ltd www.autoscribeinformatics.com.au

#### Tissue culture dishes

WPI's FluoroDish tissue culture dishes provide high imaging quality for many applications requiring the use of inverted microscopes, such as high-resolution image analysis, microinjection and electrophysical recording of fluorescent-tagged cells. Taking advantage of WPI's experience with low-toxicity adhesives, FluoroDish uses a specially formulated adhesive that is optically clear, durable and with low toxicity.

Tests by an independent laboratory have shown that the 96 h surviving rate of embryos is 100% when kept in FluoroDish — said to be substantially better than other brands. The bottom glass has good UV transmission — 30% transmission at 300 nm.

#### Coherent Scientific Pty Ltd www.coherent.com.au





Fire can pose a serious and immediate fire risk in laboratory environments, making adequate fire protection crucial to the safety of technicians and workers.

he laboratory is home to hazardous non-infectious materials including chemicals; corrosive, flammable or toxic substances; and radioactive materials which must be properly stored, labelled and handled to protect the safety of lab workers and prevent possible burns or fire.

The risk of fire is particularly high in this environment, with the presence of elements that may lead to ignition and combustion, such as temperature-controlled instruments, flammable agents and chemicals.

Laboratory fires are one of the most devastating avoidable incidents. Not only can an unexpected fire pose a serious risk to the life and safety of workers, but may also result in extensive damage to extremely valuable equipment and property.

Fire in a laboratory can also have a devastating impact on production and outputs, with the potential to cause extensive damage or the loss of important assets, data, samples, results or research, affecting operations long after the emergency is over

#### Managing fire risk in laboratories

Good safety practices and a safe working environment are essential to reduce injury and illness, or adverse effects on service delivery. When it comes to fire prevention, there are the obvious safety rules such as ensuring open flames are not left unattended and that no open flames should be used near flammable solvents.

To reduce the risk and impact of a laboratory fire, Wormald recommends implementing a comprehensive fire protection solution that is tailored for the specific needs of the facility, taking into consideration the nature of work carried out within the site. This should include highly specialised equipment to protect important industry-specific assets, such as fume cupboards, mitigating the risk of toxic by-products being released into the atmosphere by helping to suppress fires at the source.

# Fire safety equipment specific to laboratories

Wormald is national distributor of the FireDETEC range, which features a sensor tube that is fitted directly inside or around compact equipment enclosures, including laboratory fume cupboards,

to detect fire caused by flammable or reactive

Many lab workers will have regular access to fume cupboards, a local exhaust ventilation system commonly found in the laboratory environment to control exposure to toxic or flammable vapours, gases and aerosols.

A properly functioning fume cupboard exhausts hazardous gases, dusts, mists and vapours from a confined location and helps protect workers from inhalation of chemicals into the body, where they can directly enter the bloodstream and lodge small particles in the lungs.

FireDETEC Fume can help laboratory technicians by suppressing fires quickly, reducing the risk of exposure to biological or infectious materials, while also protecting vital equipment. The pressurised sensor tubing is highly reactive to heat, meaning that in the event of a flame-up, the sensor tube bursts, releasing an extinguishing agent that quickly and effectively suppresses fire. Digital sensors monitor extinguishing cylinder levels in real time and alert the nominated safety officer if a leak is detected.

Advanced fire protective equipment is one important way to mitigate fire risk in a laboratory

facility; however, Wormald also recommends regularly reviewing the following safety tips to ensure all the required elements of a comprehensive fire protection plan are in place.

#### Fire safety tips for laboratory managers

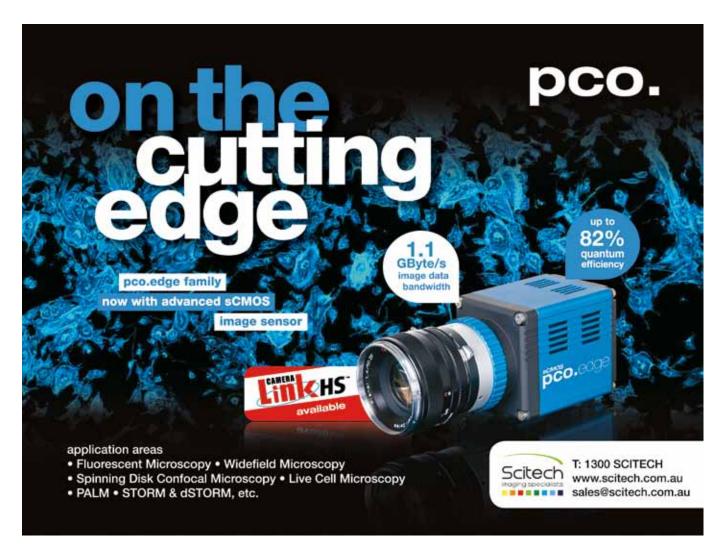
- 1. Conduct regular fire safety audits. This will help to highlight potential fire risks around the facility and determine the appropriate fire protection solution required.
- 2. Keep up to date with regulation and legislation. Laboratory managers must know their responsibilities when it comes to ethical and legal fire safety requirements, and develop an appropriate fire prevention plan in accordance with Australian Standard AS 3745:2010 'Planning for Emergencies in Facilities'.
- **3. Install adequate fire protection equipment.** In laboratory environments, more advanced fire detection and suppression systems are recommended in addition to fire extinguishers, fire hose reels and fire doors, to suit the nature of work and type of equipment used.



FireDETEC Fume can help laboratory technicians by suppressing fires quickly.

- **4. Service and maintain.** Successful fire protection requires installed systems and equipment perform to the standard to which they were originally designed and installed. Today's technology can help to keep laboratories compliant and up to date, with Wormald providing an online portal that offers instant visibility of equipment maintenance and servicing in accordance with Australian Standard AS 1851.
- **5. Use appropriate signage.** Include signage to identify all hazards, fire protection equipment and emergency exits. Additionally, all chemicals, corrosive, flammable or toxic substances, and radioactive materials must be properly stored, labelled and handled to protect the safety of laboratory workers and prevent possible burns.
- **6. Train and educate staff.** A confident team that is trained to respond appropriately in the event of a fire is an invaluable investment and can substantially reduce the impact of a crisis.

Wormald can help to identify potential hazards and install an appropriate fire protection solution. Wormald www.wormald.com.au





#### Scanning electron microscope

The TESCAN CLARA is a versatile, ultrahigh-resolution scanning electron microscope (SEM) that has been designed with the needs of materials scientists in mind, providing high performance across an array of different material types.

Achieving sub-nanometre resolution, the product reveals fine details about the structure of the user's material. TESCAN's Wide Field Optics allow users to quickly locate areas of interest at magnifications as low as 2x before zooming in to understand their make-up.

The device offers high resolution at low beam energies, making it suitable for imaging beam sensitive and non-conductive samples. Good low energy performance also makes it suitable for surface topography measurements. It is thus useful for central analytical facilities and materials research labs that value not only low kV resolution, but also the ability to select secondary and backscattered electron contrast methods to explore the information that the sample may contain.

While the system's optics have been designed specifically for imaging, the chamber has been optimised for microanalysis. It has been designed to integrate a large number of analytical detectors and spectrometers, allowing users to customise the configuration to suit their specific application and providing the flexibility to carry out complex experiments.

The product will be useful for any central imaging facility, materials characterisation lab or industrial inspection operation, due to its next-generation hardware and precision optics. The intuitive and modular user interface can be tailored to the needs of each operator, streamlining their individual workflows. Set-up routines and optimal imaging conditions enable novice users to easily capture high-quality images and bring high-end functionalities within reach.

The SEM is designed to meet the needs of multipurpose microscopy facilities interested in morphological and compositional analysis of materials at the micro and nanoscale. Its imaging capabilities are useful across a range of applications, from highend research to teaching.

**AXT Pty Ltd** www.axt.com.au













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#### Centrifuge series

Scientists working across biopharmaceutical, academic research and clinical diagnostic applications can now access a series of sophisticated next-generation centrifugation systems designed to offer high performance, consistency and safety. The centrifugation systems feature a full-colour, user-friendly touchscreen interface, enabling a high level of functionality for laboratory efficiency.

Featuring an ergonomically enhanced, novel industrial design complemented by a wide range of rotors, the Thermo Scientific General Purpose Pro Centrifuge Series has been developed to deliver a safe and regulatory-compliant benchtop separation solution to meet an array of application needs, from clinical protocols and cell culture procedures to microplate processing. The series has been equipped with a touchscreen interface that gives users easy access to pre-stored protocols, temperature control and system health checks designed to improve productivity and reduce time spent performing manual maintenance.

The product has an ergonomically enhanced industrial design that enables the quick and safe change of any of its 19 rotor types in just 3 s through its Auto-Lock Rotor Exchange function. Its Fiberlite Carbon Fiber Rotors and ClickSeal Biocontainment Lids offer high sample capacity, performance and biocontainment levels. A compact separation solution features connectivity-ready technology, while optimising benchtop space.

The series includes the Thermo Scientific Sorvall, Thermo Scientific Multifuge and Thermo Scientific Megafuge configurations, which can be easily configured with a selection of rotors to address a range of application needs.

Thermo Fisher Scientific www.thermofisher.com.au

#### Under-counter -20°C laboratory freezer

The small footprint of the 139-litre Laboratory Freezer with electronic controller (LGUex 1500) makes it a suitable choice for laboratories, hospitals and pharmacies needing to store critical samples, medical devices and clinical trial products.

The temperature setting range of the 139-litre Laboratory Freezer is between -9°C to -26°C and temperature can be altered using the soft touch keypad of the electronic controller. Alarms are factory set as a difference of  $\pm 3$ °C from the user's desired set temperature and audible/visual alarms signal when these limits are exceeded for accurate temperature control.

The freezer has a static (no-fan) cooling system and requires manual defrost to ensure critical samples are stored at the precise temperature-controlled conditions and for maximum temperature uniformity.

Connecting the freezer to a remote monitoring and building management system can be facilitated using the volt-free alarm contact, RS 485 serial port or by using the 10 mm access port for integration of an independent temperature sensor.

Other safety features include a data memory to log temperature and alarm events, a keypad lock to prevent temperature and alarm settings from being changed, and a physical lock to protect against unauthorised access.

The 139-litre Laboratory Freezer with electronic controller (LGUex 1500) is energy efficient, uses a natural refrigerant and is certified to 2014/34/EU (ATEX), making it also suitable for storing flammable substances.

#### Andi-Co Australia liebherrprofessional.com.au





#### Lattice light-sheet microscope for live cell imaging

The Luxendo InVi SPIM AIM lattice light-sheet microscope features an advanced illumination module (AIM) for low-phototoxicity light-sheet fluorescence microscopy of live samples.

Leveraging the general benefits of single-plane illumination microscopy (SPIM) with high photon efficiency and short illumination times, the module enables the user to interactively customise the light-sheet shape to tailor the system to a particular specimen's requirements. A variety of illumination patterns, including single or multiple variable Bessel beams, lattice light sheets and structured illumination, provides a range of single-instrument research possibilities for rapid, high-resolution 3D imaging of living cells.

The Luxendo InVi SPIM AIM lattice light-sheet microscope uses the highperformance InVi platform for gentle long-term imaging with precise control of physiological conditions. It has been designed to combine the advantages of

several different illumination approaches to deliver the flexibility required to optimise bioimaging experiments, from a large field of view and high temporal sampling to spatial resolution at the physical limit.

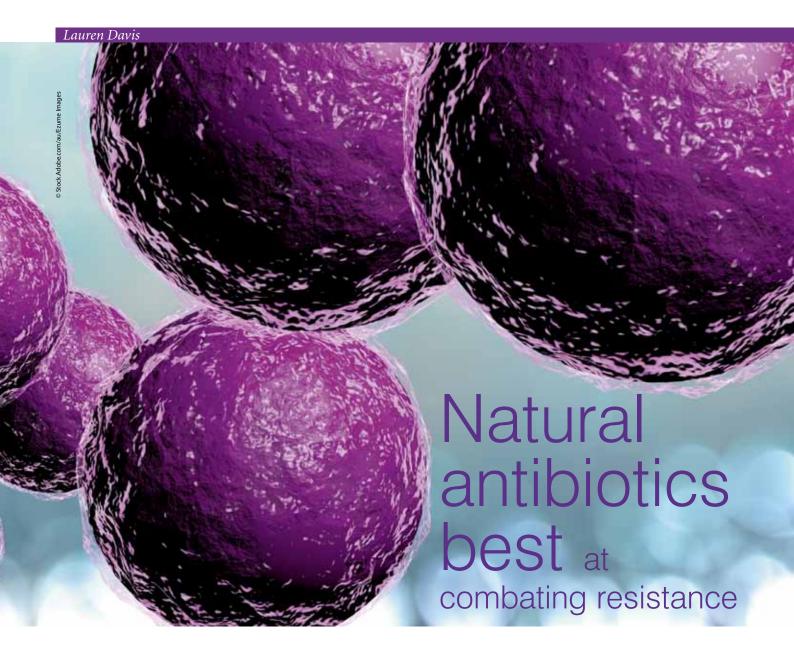
The AIM expands the capabilities of the InVi SPIM systems with a choice for the optimal light-sheet for the experimental requirements, which is said to lead to better resolved images. This next-generation, lattice light-sheet microscope gives researchers the freedom to customise the light sheet and tune the microscope to a specific biological application, providing advantages in live-cell investigations with higher resolution.

The system maintains the ease of use and stability of the InVi SPIM, while enabling illumination of the sample with flexible light-sheet patterns. These patterns include the classical static Gaussian light-sheet and the scanned Gaussian beam, as well as sophisticated illumination schemes like Bessel beams or lattice light-sheets, improving the microscope's resolution in time and space, while minimising phototoxic effects. The light-sheet geometry can be adapted to the sample in an easy, completely computer-controlled manner to offer high-resolution imaging in a user-friendly framework.

SciTech Ptv Ltd www.scitech.com.au







Natural antibiotics may be more effective than their synthetic counterparts at remaining effective in the wake of antibiotic resistance — although that doesn't mean they can't be given a helping hand along the way.

he development of antibiotics is one of medicine's great success stories — but many experts fear that we could soon enter an era without antibiotics, because more and more of the available drugs are losing their effect due to resistance. Yet antibiotics were not invented by the pharmaceutical industry, noted Birgit Schittek from the University of Tübingen: "Indeed, numerous bacteria produce these active agents naturally, and have probably done so over long periods of evolution, without loss of effectiveness."

Three years ago, Tübingen researchers discovered that the natural antibiotic lugdunin can disrupt the energy balance of pathogenic bacteria and kill them. Writing recently in the journal Angewandte Chemie, they revealed that benign bacteria on the human nasal mucosa produce lugdunin to deter the pathogen Staphylococcus aureus.

"[But] why lugdunin remains highly effective to the present day was a complete mystery," Schittek said.

Now, the researchers have discovered that Lugdunin not only has a direct antimicrobial effect on *S. aureus*, it also has two completely unexpected properties, as explained by Tübingen researcher Andreas Peschel.

"Firstly, it works in combination with antimicrobial peptides that make up our human cells," he said. This increases its efficacy and hinders the development of resistance.

"Secondly, it binds with a human receptor protein called TLR2. This stimulates the immune cells and activates the immune response in such a way that *S. aureus* has no chance of becoming established and causing infections."

Writing in the journal *Nature Communications*, Schittek and Peschel stated that a natural antibiotic such as lugdunin — which attacks on several levels, more or less independent of one another — is better

at preventing resistance than a chemically produced substance that has only a single target in the bacterial cell. The German Center for Infection Research (DZIF) is now further developing lugdunin so that it can be used for treatments in the future, and it is hoped that the research will help scientists develop drugs that work with similar effectiveness.

Meanwhile, researchers at the University of Tokyo have identified their own drug candidates to treat antibiotic-resistant infections, including the superbug MRSA (methicillin-resistant Staphylococcus aureus), by artificially enhancing a natural product. Their work has also been published in Nature Communications.

The researchers first identified the natural antibiotic from a soil sample collected in the subtropical island of Okinawa in south-western Japan. First described in the journal Nature Chemical Biology, the antibiotic — called lysocin E — is said to have a unique mechanism of killing bacteria compared to the currently available classes of antibiotics, making it an order of magnitude more potent than the current drug used against MRSA, vancomycin.

Lysocin E has a complex chemical structure that resembles a tambourine: a large ring with 12 short side chains. The amino acids that form those chains each contribute to the overall function of the entire molecule. Swapping the naturally occurring amino acids for different ones could enhance the function of the antibiotic, the researchers hypothesised.

"We try to find the improvements that natural selection did not make yet," said Assistant Professor Hiroaki Itoh.

The scientists focused on four side chains and tested how seven different amino acids might enhance lysocin E's antibacterial activity. All possible combinations of the four side chains and seven amino acids meant they needed to build 2401 different synthetic versions of modified lysocin E. Few researchers have done this before because many naturally occurring molecules are difficult to build synthetically, according to Itoh — but using a technique known as one-bead-one-compound library strategy, or split-and-mix synthesis, the Tokyo researchers are able to build thousands of new molecules in a single synthesis.

Once all 2401 modified lysocin E were built, the researchers tested if they retained the natural version's unique method of killing bacteria. Only 22 modified lysocin E were selected for the final round of tests to measure how effective they were at killing six common bacteria; of those, 11 showed antimicrobial activity better or equal to the original

The researchers will now study the three most potent modified lysocin E built — each said to be four times more effective at killing bacteria than their natural predecessor — to verify their effectiveness at treating infections in non-human animal models and to understand the detailed mechanism of how they kill bacteria at such low doses. They believe their method of synthetically enhancing natural products can increase the speed of early-stage drug discovery and help maximise the potential of naturally occurring complex molecules.

"Potentially, our method could be used to find other drug candidates based on promising small protein natural products, including for anticancer or antivirus," Itoh said.



#### **ELISA kits**

Proteintech provides a wide range of two-site sandwich ELISA kits as ready-to-use and sensitive immunoassay kits.

The kits are quick and simple to use, offering high sensitivity and a broad assay range. They detect quantitative protein level in serum, plasma or supernatant of cell lysates.

The sandwich ELISA kits are designed to provide a simple and elegant solution for users' immunoassay needs, delivering consistent results with high reproducibility.

Millennium Science Pty Ltd www.mscience.com.au



#### Technical lab spaces

YILD Technical Spaces has launched a 'labs-for-rental' facility in the Norwest business district of Sydney, with more spaces to follow in Brisbane and Melbourne. The spaces resemble US-style incubators for start-ups and other scientific industries, but without any co-investment or IP sharing. YILD expects that this novel concept will revolutionise the growth in scientific, biotech and pharmaceutical sectors, which need such spaces to innovate, collaborate and grow.

The company offers state-of-the-art, fully flexible technical facilities for any pharmaceutical, food and beverage, research, teaching and biotechnology operations. The space is designed as a collaborative, multitenant environment, combining modern PC2-grade labs, dry labs and ISO-level cleanrooms with hot desks, meeting rooms, a kitchen and break-out areas. It can be adapted to any scientific, clinical or commercial use.

The technical spaces feature premium furnishings and fixtures, with lab-grade AC and exhaust systems, HVAC balancing systems, articulated exhaust devices, safety storage cabinets and emergency showers. Every small detail has been looked into in regards to quality, sustainability and functionality, the company claims.

The lab rental model offers full flexibility to the client, due to the ability for customisation of the space according to their needs and specifications — including space for future growth. YILD does not require any share of the client's intellectual property, investments or shares in their company, so there are no strings attached. Clients can start immediately and are in full control of their own space.

YILD Technical Spaces Pty Ltd www.yild.com.au



#### **Bioprinting platform**

CELLINK has announced the BIO X6—a six-printhead bioprinting platform that enables users to combine several materials, cells and tools. It is claimed to be the only bioprinter that combines six printheads with CELLINK's Clean Chamber Technology and intelligent exchangeable printhead technology, and is a suitable platform for meeting the needs of advanced tissue engineers, regenerative medicine labs and cancer biologists that require high-throughput bioprinting and dispensing.

The product gives the user the freedom to combine multiple materials in one print and the capability to create more complex architectures. Organs and tissues, for example, are composed of many different cell types, so the BIO X6 enables users to combine six or more cell types to print advanced organ and tissue models.

Users have the ability to use different pressures, temperatures and printing methods simultaneously in six different positions. They can mix the cells in each printhead with a tailored bioink, providing the cells with the biological environment they need to achieve the desired architecture.

The technology was developed by CELLINK in order to advance research and clinical applications in the bioprinting field. The system comes with a movable arm mount, enabling multiple possibilities in one system. Users can either control through a Wi-Fi connection or through a detachable tablet on the movable arm mount.

Thermo Fisher Scientific www.thermofisher.com.au

#### Allergen testing kits

Today's food products often require complex processing, which can alter the nature of allergenic proteins in food, making them harder to detect. 3M Allergen testing products are designed to overcome this challenge by detecting both processed and unprocessed proteins, for predictable results in the lab.

3M Allergen Rapid Lateral Flow and ELISA Testing Kits can be used for clean-in-place (CIP) final rinse water, environmental swab samples, raw ingredients and finished food products. 3M Allergen Protein Rapid Kits meanwhile provide results in

less than 15 min.

3M Food Safety www.3m.com.au



#### Industrial label range

Avery Products has introduced a range of heavy-duty sign and label products so that businesses can provide safety messages in construction sites, warehouses, laboratories, offices and other facilities where human safety can be jeopardised.

Identifying risks in the workplace and providing adequate signage to mitigate those risks is the responsibility of every employer. Businesses can now design and print safety labels and signs immediately in their own offices or wherever they have access to a laser printer, instead of having to wait long periods for professionally printed materials to arrive at sites where they are needed.

The Avery Industrial Label Range combines durability, toughness and instant usability to warn workers of physical harm from dangerous construction zones, machinery, harsh environments, chemicals and other harmful scenarios. They are water-resistant, tear-proof, tamper-

proof and durable, so they can handle harsh environments for as long as they are required.

Avery claims to have put the labels through stringent durability tests to ensure they can withstand the rigours of tough environments, rough handling and corrosive chemical sites more effectively than paper labels and signs. The ultra-resistant labels are certified to BS5609, which means that they are saltwater-resistant for three months, making them suitable for use in many different areas.

Labels are offered in a wide range of sizes and substrates to cover every situation and eventuality. They can be printed in minutes for free using Avery Design & Print software, available on the Avery website, so managers can have a sign or label ready to use almost instantly.





FastGro is a fully chemically defined replacement for foetal bovine serum. Designed for use in cell culture, it can help mitigate common concerns associated with FBS while promoting cell growth and consistency.

Foetal bovine serum (FBS) is widely used as a supplement for in vitro cell culture media. FBS promotes healthy cell growth by providing an undefined mixture of nutrients, such as proteins, attachment factors, growth factors, lipids and hormones.

Due to its undefined nature, FBS can lead to unexpected and undesired stimulation of cells. There is also biorisk from animal protein or pathogen contamination, including risk of bovine spongiform encephalopathy (BSE).

FastGro supports the growth of a wide range of cells in vitro without the use of serum or any animal- or human-derived compounds. When used in cell culture, it offers chemically defined nature without lot-to-lot variation; no animal- or human-derived materials or compounds; no interference with hormones or growth factors; and the elimination of the risk of contaminants (viruses, mycoplasma, prions, etc).

The product is easy to use and suitable for a wide range of cell culture applications. It can be stored in the refrigerator, so there is no need for thawing prior to use.

MP Biomedicals Australasia P/L www.mpbio.com

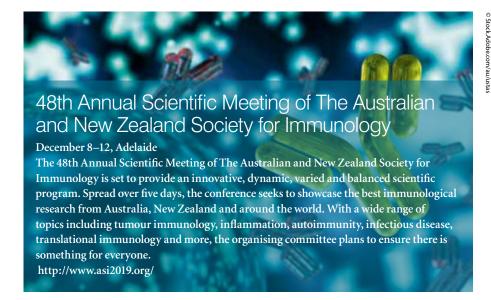




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## 5th International Symposium on the System of Radiological Protection

November 17–21, Adelaide https://icrp2019.com/

### Australian Graphene Industry Association Conference 2019

November 19, Melbourne

https://grapheneindustry.org.au/conference/

## 58th ASMR National Scientific Conference 2019

November 20–21, Fremantle

https://asmr.org.au/asmr-nsc/nsc-welcome/

#### 14th GeneMappers Conference 2019

November 20–22, Sydney https://www.neura.edu.au/event/ genemappersconference2019/

## 12th Australian and New Zealand Society for Magnetic Resonance Conference

November 25–28, Naturaliste, WA http://www.anzmag2019.com/

#### Gordon Godfrey Workshop on Spins, Topology and Strong Electron Correlations

November 25-29, Sydney

https://newt.phys.unsw.edu.au/Godfrey/2019/index.html

## Australian Society of Plant Scientists Conference

November 26–29, Melbourne https://www.asps.org.au/combio/asps-2019

#### **TeV Particle Astrophysics 2019**

December 2–6, Sydney https://indico.cern.ch/event/828038/overview

## 10th International Conference on Spontaneous Coherence in Excitonic Systems

January 28–31, Melbourne http://www.fleet.org.au/icsce/

#### 25th Annual Lorne Proteomics Symposium

February 6-9, Lorne

https://www.australasianproteomics.org/

### 45th Lorne Conference on Protein Structure and Function

February 9–13, Lorne https://www.lorneproteins.org/

## International Conference on Nanoscience and Nanotechnology

February 9–13, Brisbane https://www.iconn2020.com/

#### 32nd Lorne Cancer Conference

February 13–15, Lorne https://www.lornecancer.org/

### 41st Annual Lorne Genome Conference

February 16–18, Lorne https://www.lornegenome.org/

### 26th Australian Conference on Microscopy and Microanalysis

February 16–20, Canberra https://www.acmm26.org/welcome

#### **FOODCON 2020**

March 23-25, Melbourne

https://www.foodconferencesaustralia.com/

#### Molecular Approaches to Malaria Conference 2020

February 23–27, Lorne

https://www.mam2020conference.com.au/

#### **Human Genome Meeting 2020**

April 5–8, Perth http://hugo-hgm2020.org

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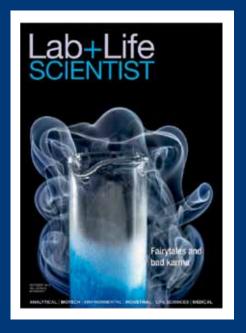
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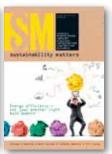


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