Lab+Life SCIENTIST

Investigating comets

The thrills that proteins provide

Bioprinting organs

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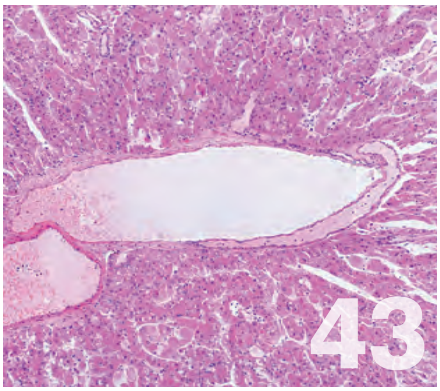

The gene genie

Researchers at ETH Zurich have created the first gene network to be operated via brainwaves. Depending on the user's thoughts, it can produce various amounts of a desired molecule.

The team, led by Martin Fussenegger from the Department of Biosystems (D-BSSE), sought to develop a gene regulation method that enables thought-specific brainwaves to control the conversion of genes into proteins, called gene expression. They were inspired by the game Mindflex, where the player wears a special headset with a sensor on the forehead that records brainwaves. The registered electroencephalogram (EEG) is then transferred into the playing environment, where it controls a fan that enables a small ball to be thought-guided through an obstacle course.

The researchers' system similarly makes use of an EEG headset. The recorded brainwaves are analysed and wirelessly transmitted via Bluetooth to a controller, which in turn controls a field generator that generates an electromagnetic field; this supplies an implant with an induction current. An LED lamp in the implant, which emits light in the near-infrared (NIR) range, turns on and illuminates a culture chamber containing genetically modified cells. When the NIR light illuminates the cells, it triggers an artificial signal cascade, resulting in the production of the desired protein.

The implant was initially tested in cell cultures and mice, and controlled by the thoughts of various test subjects. The researchers chose the glycoprotein SEAP (secreted alkaline phosphatase) for the tests, an easy-to-detect human model protein which diffuses from the culture chamber of the implant into the mouse's bloodstream. NIR light was used because it is generally not harmful to human cells, can penetrate deep into the tissue and enables the function of the implant to be visually tracked.

To regulate the quantity of released protein, the test subjects were categorised according to three states of mind: biofeedback, meditation and concentration. Test subjects who played Minecraft on the computer (concentration) induced average SEAP values in the bloodstream of the mice. When completely relaxed (meditation), the researchers recorded very high SEAP values in the test animals. For biofeedback, the test subjects observed the LED light of the implant in the body of the mouse and were able to consciously switch the LED light on or off via the visual feedback. This was reflected by the varying amounts of SEAP in the bloodstream of the mice.

"For the first time, we have been able to tap into human brainwaves, transfer them wirelessly to a gene network and regulate the expression of a gene depending on the type of thought," said Fussenegger. "Being able to control gene expression via the power of thought is a dream that we've been chasing for over a decade."

The study has been published in the journal *Nature Communications*. Fussenegger hopes a thought-controlled implant could one day help to combat neurological diseases, such as chronic headaches, back pain and epilepsy, by detecting specific brainwaves at an early stage and triggering and controlling the creation of certain agents in the implant at exactly the right time.

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Susan Williamson

Professor of Proteomics

Professor Mark Baker has built a dynamic career in molecular cell proteomics and gives some insights into the Human Proteome Project, the thrills that proteins provide in life and why we need to stop and smell the roses.

Lab+Life Scientist: How did you become interested in studying science?

Professor Mark Baker: I was the eldest in a family of seven Maroubra kids and my father died of a heart attack when I was 12. From then on I was interested in trying to find out why people died early and what was the mechanism behind disease.

That has stayed with me ever since.

LLS: What inspired you to focus on proteins?

MB: I went to Macquarie University because it had molecular biology - I think it was the first place to teach it in Australia. I ended up doing an honours degree and a PhD there on proteins and free radical biochemistry with the 'guru', Professor Jan Gebicki.

Jan taught third-year biochemistry and I became very wrapped up in his course. We had to randomly pick an enzyme 'out of the hat' to purify and I picked Cu/Zn superoxide dismutase (SOD), which had only been discovered the year before by a young guy called Joe McCord.

After that I was well and truly into proteins and free radicals.

Subsequent postdocs gave me the opportunity to start looking for protein oxidation products in vivo and that was what I really got interested in - the pathology of disease and mapping free radical damage in pathological tissues: the signatures of disease.

I was pretty lucky to draw that SOD out of a hat.

LLS: Being ill led you to change direction in your research?

MB: Yes - I contracted Guillain-Barre syndrome after the flu, which left me paralysed for six months. While I was sick I read about Jessie Bradman, Donald Bradman's wife, passing away from cancer. This inspired me to switch from colon and breast cancer research to ovarian cancer, primarily because of its lethality.

At the time I was working at the University of Wollongong and they couldn't support the work

> "... what I really got interested in - the pathology of disease and mapping free radical damage in pathological tissues: the signatures of disease."

because they didn't have a medical school. So I left Wollongong and established an ovarian cancer research centre with Michael Quinn, a surgeon at the Royal Women's Hospital (RWH) in Melbourne. I was the chief scientist and Michael was the clinical director - it was an amazing collaboration with a truly great bloke.

We had no money - the NHMRC wasn't really interested in a low-impact disease - so we looked at alternative approaches to funding our research.

We went to philanthropists, we ran opera in the Queen Vic Markets with Opera Australia as a big fundraising event. It was a success and the centre grew into what became the Women's Cancer Research Centre at the RWH.

All along I had watched proteomics with great interest because of my roots from Macquarie, but it really got going in Melbourne.

LLS: Is that when you started looking at the cell membrane proteome?

MB: It was then when we started thinking about the cell membrane proteome as a serious target.

Because the protein receptors that we were working on were membrane bound, the idea struck me that we should focus on doing cell membrane proteomics.

Identifying cell surface changes was a niche compared to looking at intracellular changes in cancer cells, but when we looked at the proteomics of membrane-bound proteins it was really difficult. Membrane-bound protein receptors are hydrophobic and in low abundance, and weren't easily studied by 2D gel electrophoresis, which was the core technology in use at the time.

That's when we switched to developing new technologies for analysing cell membrane proteins and the cancer surface proteome.

LLS: What made you switch to working in industry?

MB: While we were setting up ovarian cancer proteomics at RWH, I was offered a position in industry in San Francisco with a biomarker discovery company called Lumicyte. My UNSW-trained brothers had always pushed me to consider working seriously in industry.

So, I moved to San Francisco in 2000 and had three of the best years of my life.

At that time proteomics was going through a mindset technological shift and I got to work in a company that had hand-picked 50 of the best multidisciplinary minds to address problems around the use of MALDI mass spectrometry for biomarker discovery, including most cancers.

Lumicyte had 20 mass spectrometers in one room - it was the most any lab anywhere in the world had at that time. It was very cool to develop a chip-based platform with world-class 'Silicon Valley' big science informatics from scratch.

Whilst this next-gen technology was being developed at Lumicyte, the world was starting to adopt proteomics. John Yates in San Diego published his ideas about shotgun proteomics, which is where you take the whole proteome without separating it, digest the proteins up into peptides, separate them and then analyse them by mass spec.

We were starting to discover that these technologies could accurately and simultaneously look at hundreds to thousands of proteins rather than the old story of one or two at a time. And we (and many other colleagues) were beginning to think we could use these technologies to map the whole human proteome.

LLS: Did that work lead to the patents you hold?

MB: One of the patents came from initial work I did at RWH and that I shared with Greg Rice. Basically that idea got grandfathered with other more advanced biomarker discovery ideas I had at Lumicyte.

When I was at Lumicyte I had an idea that has led now to three patents. Very generously, the company released the technology to me and when I came back to Australia I patented it back at Macquarie.

The patents involve making more visible many of (… not all) the low-abundance proteins found in biofluids using solid-phase polyclonal chicken antibodies raised against chromatographically separated plasma to deplete the most abundant proteins - this allows us to reproducibly see proteins previously not seen in samples like human plasma, as our recent submission to PeptideAtlas demonstrates.

LLS: What brought you back to Australia?

MB: The biotech boom in 2003 was almost over in the States and things were getting pretty tough. Lumicyte looked like it was going to be sold - it did end up getting sold to Qiagen in Germany - and I saw an ad for the

CEO position at the Australian Proteome Analysis Facility (APAF) back at Macquarie University.

I was also missing my two kids Matt and Tegan a lot, as well as the surf at Maroubra and watching the mighty Rabbitohs play - so I decided to bring the technology, business acumen, biomarker discovery skills and other loves back home to Australia and focus on making a significant difference to the emerging science of proteomics back home.

At that stage a number of key proteomics people had left APAF and Macquarie to have their shot at private industry through Proteome Systems Ltd.

APAF was in pretty bad shape, losing significantly every year, and was luckily refunded for national functional proteomics services in an expanded commercial format.

LLS: And you managed to turn APAF around?

MB: Yes. Rather than being an intellectual and curiosity driven research centre set up by Keith Williams, it became a fully fledged national service provision company reliant on modern high-throughput mass spec-based proteomics. And that's when APAF really started to flourish.

It was a cooperative between the University of Sydney, UNSW, Macquarie University and TGR Biosciences in Adelaide. Those four organisations were what was called APAF Ltd up until NCRIS Bioplatforms Australia was launched, which I was closely involved in.

APAF Ltd was very much a forward-looking company. It had an independent, nationally focused board governing it - rather than any university - with an independent chairman, Geoff Grigg, who was an ex-CSIRO dual divisional head.

Australian researcher and industry costs were offset heavily, giving people access to world-leading services at a reasonable price.

APAF Ltd reinvested any profit back into buying brand new infrastructure - as mass spectrometers were turning over about every 4 to 5 years. This attracted new business and new researchers who wanted access to state-of-the-art technologies.

We also had world-class technicians, most of whom had PhDs.

LLS: Why did you leave APAF?*

MB: In 2009, Macquarie decided to 'roll' APAF Ltd and its staff back into the university, cut previous affiliations and focus on other benefits.

They saw the recently won NCRIS investment as a grant. Knowing my preference for the commercial model I decided it was best to focus on other outcomes.

LLS: Do you think Australia is falling behind by not supporting researchers with up-to-date infrastructure?

MB: It's really quite staggering the investment that is

going into the proteomics field in Asia and some parts of Europe now. Undoubtedly, this means Australia will continue to fall behind.

It's not good enough to have a 2- or 5-year plan, we need a 20-year coordinated plan in place regarding infrastructure investments, along with a commitment up front that R&D infrastructure in both human health *and* basic research is absolutely critical.

We have the opportunity and the will to work collaboratively as teams across the Australian sector - we are so small the only way to have a real impact globally is to work together.

We need big projects, big teams, big infrastructure and far more centres of excellence.

It's frustrating - the maximum you can put in for a centre of excellence is $28 million over 7 years, but how can that compete with the Chinese who are putting in $100 million a year for the next 10 years?

If we want to find out how to treat a particular cancer or a particular disease, we need to understand that disease in greater detail and resolution than we currently do. We haven't completed the human proteome so medicine still has a long way to go before we fully understand the organism that we call the human being.

We know most of the human genome now, but we only know about 70-75% of the proteome.

If you were a Ferrari car manufacturer and blocked out 25% of the parts list of the car and then tried to put one together only having/knowing 75% of the parts, it would be a pretty ugly Ferrari indeed - it's the same with a human being.

LLS: Can you talk about your involvement with HUPO and the Human Proteome Project?

MB: After I left APAF Ltd I refocused my efforts around the Human Proteome Project (HPP) and became much more involved with the Human Proteome Organisation (HUPO).

I was in the Bay Area when HUPO started and have been involved with the organisation from day one.

HUPO was set up as the worldwide governing body overseeing three regions - the Americas, Europe/Africa and Asia/Oceania.

I was also involved in setting up the Asia/Oceania region and established the Australasian Proteomics Society (APS) with Richard Simpson in 2003. I am an invited speaker at this year's Lorne APS Conference and plan to discuss how my team's cancer cell membrane protein data shows that specific interactions differentially drive changes in colorectal cancer signalling.

In 2010, with Ian Smith, Ed Nice and Marc Wilkins, we ran the 9th HUPO World Congress here in Sydney, which is when HUPO launched the ambitious HPP.

The first thing HUPO agreed to do was to look at where we had strong evidence either at a mass spec or antigen-antibody level for protein-coding genes - because we hadn't even mapped onto the proteome what proteins we knew anything about.

So HUPO decided to take a multipronged approach and assemble all the information in a big database to look at the human proteome from as many angles and perspectives as we could. As well as evidence for protein-coding genes, we looked at where the proteins were located, what they do, what they interact with, what modifications they have, what switches them on and off.

We also agreed to give every protein equal value and not just chase someone's favourite protein/s which, by the way, for me is the urokinase receptor uPAR - a protein I've worked on for 25 years now. Instead each protein became just one of the 20,300 proteins - or far more if you consider all possible derivatives.

Over the last three years HUPO has taken this approach and identified the proteins for which there is really good evidence and the ones where there isn't much evidence.

As part of these efforts, two recent *Nature* papers with draft maps of the proteome were published this year and a new version of the Human Protein Atlas was also released in November 2014 - all of which have been coordinated with HUPO's standards and database efforts and were discussed at length at the recent HUPO Madrid Congress.

LLS: How do you get your head around the mind-bogglingly huge number and variation of proteins in the human proteome?

MB: This is hard - I think one can comprehend that proteins work in teams or social groups, a bit like us humans. If you understand the individual components and dynamics of the team - who works best with who and how they work together with what resources - then you understand how to optimise your team.

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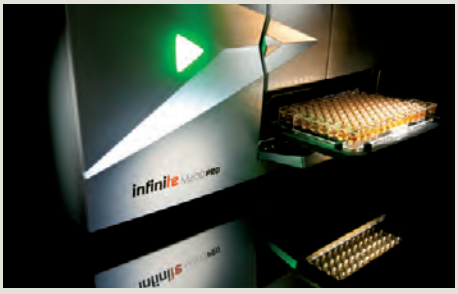

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The current draft map of the human proteome is simply one representation of our combined current knowledge about human proteins using just mass spec and/or antibodies. It's like saying here's the baseline, now we can really start to understand protein variants (PTMs) and how the protein teams get put together. Collectively, some have termed this the interactome - how members of the proteome work together.

LLS: And it involves a lot of data management?

MB: Yes, with proteomics we are talking about simultaneously identifying and quantitating thousands of proteins and modifications - that's why it's called the big science-big data revolution.

We now have a vast array of available tools - mass spec-based quantitative assays, biochips and multiplexed ELISA and affinity platforms (some combining each) that can simultaneously measure hundreds of proteins instead of just a single individual protein.

LLS: Has the HPP provided any new insights into what we don't know about humans yet?

MB: Yes - there are some big gaps in our knowledge.

We've found families of proteins that we don't know very much about. For example, the olfactory receptors that Linda Buck and Richard Axel found and won the Nobel Prize in Physiology or Medicine in 2004 is the most 'missing' of all the protein families.

We think each of these receptors occur in very low abundance in only a few cells at a time, so it's really hard to detect them by mass spec - one nerve cell expresses one olfactory receptor and is responsible for detecting and sending a signal to the brain about one chemical. Next door to that cell is a different neuron expressing a different olfactory receptor that picks up a different smell.

Research groups worldwide are now finding these olfactory receptors in other organs of the body, not just the nose, where they appear to be involved more broadly in chemosensation.

So we've realised we know very little about the olfactory receptors.

I suspect that this part of the human proteome is going to open up all sorts of amazing knowledge about human behaviour, emotions and how memory is implanted simultaneously with experience. For example, the memory of a family member or friend can be driven by a smell you associated with them - like walking past a bakery and smelling a particular type of bread can remind a person of their grandmother and make them cry when they smell that smell. Human history is full of stories just like that.

There's over 500 olfactory receptor genes in humans, which is a small number compared to mice or elephants, who are more reliant on smell than we are - we are more reliant on sight.

Identical twins: Mark A Baker (Newcastle) and Mark S Baker (Macquarie) sharing a beer at HUPO2010 where the Human Proteome Project was launched.

The olfactory receptor also is a part of our genome that we appear to be losing the fastest in a long-term evolutionary sense. I think what we (and HUPO) need to do is *smell the roses* a bit more, so to speak, maybe to save our olfactory receptors.

LLS: You also have an interest in the truffle proteome?

MB: Funny - that's a bit of a hobby. I'm also interested with other mates like Ed Nice, Ian Smith and James Whisstock at Monash (and I'm sure quite a few other scientists around the planet) in epicure and the science of great cuisine and wine.

It's something a group of us did for the fun of it and it's been a runaway success.

A French group and colleagues published the genome for the black Périgord truffle - so I thought about analysing the truffle proteome.

And of course you smell truffles with your olfactory receptors, and because we were interested in that proteome we wanted to work out what was the biochemistry of the truffle that led to the production of the famous truffle perfume.

Also, we were ahead of Europe because truffles grow in the other six months of the year in the Southern Hemisphere - so we had a six-month lead on them. And Australia is pretty fast at proteomics analysis.

So with Shoba Ranganathan's marvellous bioinformatics analyses we published the Périgord truffle proteome in the *Journal of Proteome Research*, and recently, whilst visiting the south of France, we found that the French populist discovery magazine *Sciences et Avenir* had picked up the story!

That's what you can do when you've got the technology - and we have it here in Australia - you can help an industry like the Australian truffle growers understand their product a lot better. Hopefully, this will help them find markers of authenticity in case there are cheap species brought onto the market - which does happen overseas - and we can develop an understanding of the biochemistry of an organism when previously it was a black box.

LLS: What do you see proteomics being applied to in the future?

MB: I think we are going to end up with something like a wellness health biochip, and I know that there are a number of people around the world working on just this concept now.

Maybe we'll go to the doctor, have a blood test simultaneously measuring 30 or 40 different proteins on the chip and this will give your doctor an index of how well you are for someone your age, sex and genotype.

One thing we are realising in doing plasma proteomics is that as men and women age there are differences in their plasma proteomes.

So, instead of there being a reference range for all humans, there should be 'personalised' reference ranges established for each decade of life, for each sex and maybe for different races on the planet.

We are going to come to a time not so far away where molecular pathology could simultaneously look at one hundred proteins at the same time on a tissue slice of a tumour, or any other disease, whereas previously using immunohistochemistry we would just identify one 'marker'.

This will generate a molecular signature of disease and will allow treatments to be based on this particular molecular signature rather than what we currently do, which is treat cancer with reference to what organ it emanates from.

In the future we will have treatments approved for particular molecular signatures of cancers rather than because it happens to be in the brain or the gut or the breast or the skin.

LLS: And the future for HUPO?

MB: One thing moving forward for the Human Proteome Organisation (HUPO) is to develop a set of success examples that very clearly explain to the public and funding agencies what proteomics has already delivered and what it is promising to deliver in future.

HUPO has been very much run on an academic basis and we need to make proteomics understandable by generating examples the average person can understand - like people are now starting to understand their genomes.

It's about familiarity. We've sold the genome - actually we've probably oversold it because the public wrongly believes genes are the bits that actually do things in their body when in fact they are the coding instructions for life and it's the proteins that do the work - do the living.

The thrill of driving a Ferrari is actually in driving it (the proteins), not looking at it on a computer as a blueprint (the genome). Like Ferraris, proteins are the thrill of life.

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Vale Don Metcalf AC

Professor Donald Metcalf AC, an outstanding Australian medical researcher whose discovery of colony stimulating factors (CSFs) has benefited millions of people with immunodeficiency, passed away this week at the age of 85.

Metcalf joined the Walter and Eliza Hall Institute in 1954 as a young medical graduate, supported by Cancer Council Victoria's Carden Fellowship, an award he held until his retirement in September 2014.

Metcalf's studies of how blood production is controlled led to his speculation there must be a biological mechanism that controlled white blood cell production. He named them CSFs and they became the focus of more than 50 years of research.

Metcalf led researchers to characterise and purify four CSFs as well as recognising that CSFs had a potential role in clinical medicine. His team was among the first to discover the genes for CSFs.

Metcalf was a central figure in international clinical trials of CSFs in the 1980s. These trials assessed whether CSFs could boost immune cell numbers in cancer patients whose immune system was weakened as a side effect of the chemotherapy, leaving the patient susceptible to infection.

An estimated 20 million people have now been treated with CSFs.

As well as boosting the immune system in people treated with chemotherapy or with other immune deficiencies, CSFs have revolutionised blood stem cell transplantation, contributed to other diseases such as rheumatoid arthritis, and medications that block CSF function are now entering clinical trials.

Metcalf was also a mentor to hundreds of young researchers and among his many honours and awards were the Companion of the Order of Australia (1993), the Royal Medal of the Royal Society (1995) and the Prime Minister's Prize for Science (2001).

Metcalf died on 15 December 2014 at the age of 85 and is survived by his wife Jo, daughters Kate, Johanna, Penelope and Mary-Ann and their families.

AB SCIEX announces cloud computing project

AB SCIEX and Illumina have announced the OneOmics project - an exclusive partnership to bring together SWATH-based, next-generation proteomics (NGP) and next-generation sequencing (NGS) tools in a cloud computing environment. The AB SCIEX SWATH Proteomics Cloud Tool Kit suite of applications will be hosted in BaseSpace, Illumina's applications store and cloud-based informatics community dedicated to advancing genomic analysis, at www.basespace.com.

The partnership enables BaseSpace to be used as a single location for genomics and proteomics big data. With fast, secure, streamlined analysis of complex multi-omics data sets, the solution will help advance biomarker discovery and aid research into diseases such as cancer, diabetes, Alzheimer's and heart disease.

The AB SCIEX SWATH Proteomics software solves the 'missing data problem', wherein traditional 'shotgun' proteomics measures an incomplete set of proteins that are difficult to reproduce. It makes reproducible proteome research feasible across many samples and is further enhanced through integration with Illumina NGS technologies.

AB SCIEX President Rainer Blair said the software "allows thousands of proteins to be examined at once with almost no method development - and now, with our cloud-based applications, customers can process data 50 times faster". The toolkit brings a growing list of BaseSpace apps to extract biological insight from SWATH proteomics mass spectrometry data, including:

- Protein Expression Extractor - for processing raw mass spectrometry data
- Protein Expression Assembler - for protein fold-change analysis
- Protein Expression Browser - to visualise results in biological context
- Protein Expression Analytics - for data quality review

"These new proteomics tools add systems biology capabilities to BaseSpace, creating an easy-to-use, cloud-based environment that enables rapid data analysis for a growing range of applications," said Nicholas Naclerio, Senior Vice President, Corporate Development and General Manager, Enterprise Informatics for Illumina. "Now, BaseSpace is making informatics accessible to anyone searching for a truly interdisciplinary, systems-level understanding of biology."

AB SCIEX has also announced that its director of reagent R&D, Dr Subhasish "Babu" Purkayastha, has been awarded the Human Proteome Organization (HUPO) Science and Technology Award for efforts in commercialisation of isobaric labelling for protein quantification with the development of iTRAQ chemistries.

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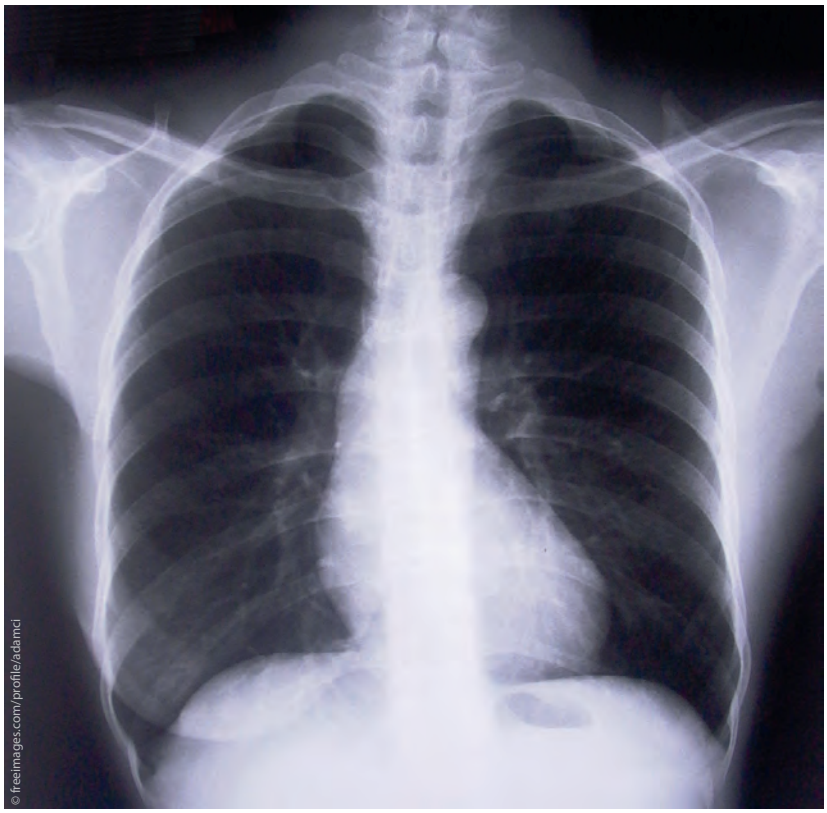

As part of the announcement of their new Asia Pacific Innovation Centre, Johnson & Johnson - parent company of Janssen - will facilitate new collaborations with Australian university researchers.

One collaboration is with parasitologist Professor Alex Loukas at James Cook University in Cairns in which Janssen will provide financial support to progress work on a protein produced by hookworms that shows promise as a treatment for autoimmune and inflammatory diseases, such as inflammatory bowel disease, Crohn's disease and asthma.

"It's very exciting for us to have a big pharma like Janssen jump in at what is a very early stage research," said Loukas, adding that he pitched their work to Janssen at the AusBiotech national conference last year. "This stage of research - after early discovery work but before clinical trials - can be hard to find funding for. The Asia Pacific Innovation Centre is a welcome development for it bridges that gap."

The relatively innocuous parasitic hookworm lives in the small bowel and releases a secretion with anti-inflammatory properties that help it go unnoticed by the human immune system.

"Having a few hookworms can actually be beneficial," said Loukas. "They can protect people against autoimmune diseases."

After exploring the active components of the hookworm secretion, one protein became the focus of Loukas's work.

"We identified a protein, synthesised it and showed that it had protective properties in mice models for colitis and experimentally induced asthma," said Loukas.

The protein drives the expansion of regulatory T cells, the 'peacekeepers' of the immune system that reduce or balance the inflammatory response.

Further developing this protein is the focus of the collaboration with Janssen and over the next year Loukas will develop a portfolio of preclinical data, such as how best to synthesise the protein and better understanding its mechanism of action.

The Asia Pacific Innovation Centre was launched at the 2014 AusBiotech national conference. Based in Shanghai, it will be headed by J&J executive Dong Wu and will include satellite offices in Australia, Singapore and Japan.

Expansion underway at WANRI

Roger Hussey has joined the Western Australian Neuroscience Research Institute (WANRI) as its new chairman and Dr David Blacker has joined the institute as its new medical director.

Together with three new board members who started in mid-2014, the two appointments add to the expansion taking place at WANRI.

According to WANRI CEO Steve Arnott, the institute plans to double the size of its research team over the next five years, along with expanding the facility.

"We have an ambitious vision for the future, one that puts WANRI, and in turn Western Australia, on the world stage as a centre of excellence in neurology research," said Arnott in a statement.

Hussey was previously chairman of the Princess Margaret Children's Hospital and the PMH Child Health Research Institute (now Telethon Kids Institute). He currently serves on two government enterprise corporations, as chairman of the Southern Ports Authority and deputy chair of Landgate, and on the Bali Eye Humanitarian Foundation in Indonesia.

Blacker is a neurologist and stroke physician at Sir Charles Gairdner Hospital and Adjunct Clinical Professor of Neurology at the University of Western Australia. He has a longstanding association with WANRI as an Honorary Research Fellow and is active in shaping policy on neurological care.

New leaders at WANRI, chairman Roger Hussey (above) and medical director David Blacker.

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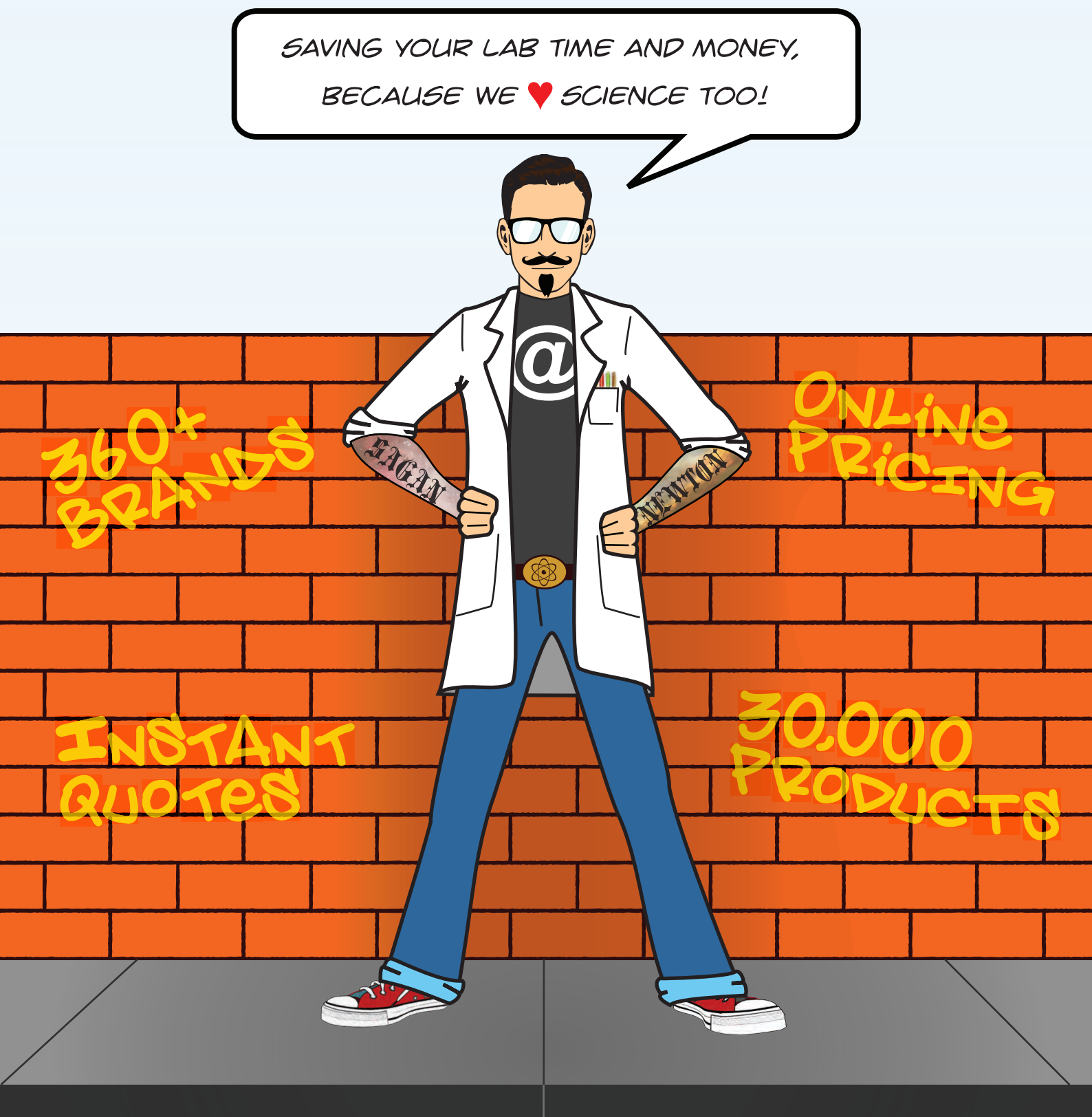

Prime Minister's Prizes for Science

This year's Prime Minister's Prizes for Science have been announced with the achievements of six recipients celebrated at a black tie event at Parliament House in Canberra.

The prizes are a tribute to the contributions Australian scientists and science educators have made to economic and social wellbeing as well as inspiring and encouraging an interest in science.

The 2014 recipients are:

- Laureate Professor Sam Berkovic and Professor Ingrid Scheffer, from the University of Melbourne, who received the $300,000 Prime Minister's Prize for Science for their research on the genetics of epilepsy. Their work has resulted in better targeted research, diagnosis, management and treatment for many forms of epilepsy.
- Professor Ryan Lister from the University of Western Australia was awarded the $50,000 Frank Fenner Prize for Life Scientist of the Year. Lister's research involves mapping how our genes are turned on and off, revealing why a leaf cell is different to a root cell or a stem cell differs from a skin cell; research that has the potential to transform agriculture, regenerative medicine and our understanding of the workings of the brain.
- Dr Matthew Hill, who leads the Integrated Nanoporous Materials team at CSIRO, was awarded the $50,000 Malcolm McIntosh Prize for Physical Scientist of the Year for his work demonstrating that the space inside metal-organic frameworks (MOFs) can be used as an efficient and long-lasting filter to clean up water, natural gases and pollution.

- Mr Geoff McNamara was given the $50,000 Prime Minister's Prize for Excellence in Science Teaching in Secondary Schools for his program for higher-achieving students at Melrose High School in Canberra, which has been so successful he is now offering it to other schools. He and his school will share the $50,000 prize money.
- Mr Brian Schiller received the $50,000 Prime Minister's Prize for Excellence in Science Teaching in Primary Schools for his work on enhancing student learning by integrating science and Japanese language studies. His student-initiated investigations nurture creativity and encourage his students to ask the big questions. He and his school, Seacliff Primary School in Adelaide, will share the prize money.

From next year, the Prime Minister's Prizes for Science will feature a new award, the Prime Minister's Prize for the Commercial Application of Science, to recognise the important role innovation plays in partnership with science.

Further information about the 2014 award recipients is available here.

Online science TV channel launched

New online science television channel riaus.tv will promote the public awareness and understanding of science by delivering free science-based content to Australians.

The channel will operate out of Adelaide and is run by national science communication organisation RiAus.

Media solutions company Hostworks partnered with RiAus to host the TV platform. Content will be available across digital media platforms from desktops to tablets and smartphones.

"RiAus TV will provide a great opportunity to encourage conversations about science," RiAus Director Dr Paul Willis said in a statement. "RiAus TV will have something to appeal to everyone, from school students to professionals to science first-timers.

The University of Adelaide, Flinders University, University of South Australia, University of Queensland, Queensland University of Technology and industry organisations, including the Defence Science and Technology Organisation (DSTO), have signed up as partners for RiAus TV.

Upcoming broadcasts include personal interviews with leading science communicators including Australia's Chief Scientist Professor Ian Chubb and Canadian biologist Dr Carin Bondar.

Plans for a joint A/NZ regulator called off

The plan by the Australian and New Zealand governments to establish a joint therapeutic products regulator, the Australia New Zealand Therapeutic Products Agency (ANZTPA), has been taken off the table.

In a joint statement, Australian Health Minister Peter Dutton and New Zealand Health Minister Jonathan Coleman said the decision was taken "following a comprehensive review of progress and assessment of the costs and benefits to each country of proceeding".

The two countries will continue to cooperate on the regulation of therapeutic products, with the TGA and New Zealand's Medsafe to explore other regulatory harmonisation activities.

These include a new information-sharing agreement, mutual recognition of good manufacturing practice audits, as well as reducing compliance costs of trans-Tasman applicants.

Australia and New Zealand also plan to continue independently with their own regulatory reform programs, and health ministers will continue to cooperate through a bilateral agreement. New Zealand will continue to participate in the Council of Australian Governments health council.

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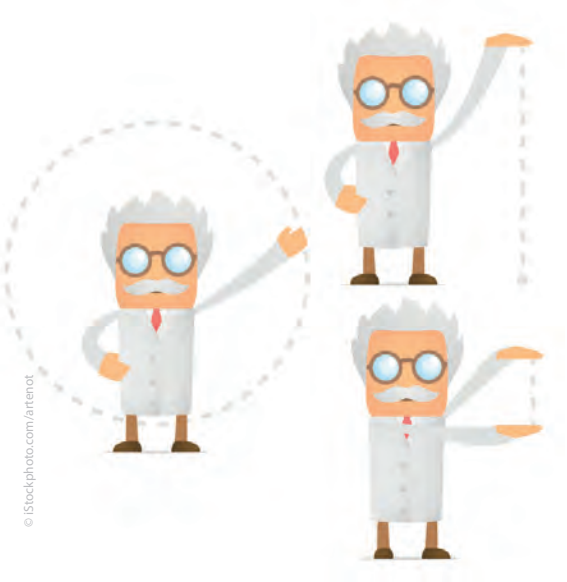
Measuring the true reach of research



Published research has become more widely available, thanks to open access. Along with this increased exposure comes the increased uptake and use of work, which can make measuring the true impact of research challenging.

A new database template has been developed by the Centre of Research Excellence in Rural and Remote Primary Health Care to help researchers better assess the reach of their work.

The tool records published journal articles for a particular research project plus the wider impact the research has had such as conference presentations, media exposure and its uptake or use.

Developed in Microsoft Access, the tool can accommodate research projects across multiple institutions or those conducted at an individual institution.

"Being able to demonstrate the wider influence of research, rather than just published journal articles, is a lot more difficult," said Monash University's Lisa Lavey, who led the development of the tool.

"The centre started with a very simple database that grew into a tool that can handle complex data. It can now record an incredible amount of detail, including the traditional journal articles, books and conference presentations, as well as stakeholder presentations, media contact and evidence of uptake or use of research."

Indicators of impact are organised by domain (academic, policy, service delivery and society at large) and whether those impacts were initiated by the centre or institution, or by the user of the research.

The database template is available free of charge under a licence agreement with Monash University.

Plan B and the MRFF

The Abbott government has retained its commitment to raise $20 billion for the Medical Research Future Fund (MRFF) with its revision of the controversial GP co-payment.

In 'Plan B', the government will change the $7 GP co-payment to a $5 co-payment and provide an adequate safety net for the most vulnerable and disadvantaged in the community.

It appears the proposed funding model for the MRFF will remain the same with the rebate cut savings supporting its formation.

Director of the Walter and Eliza Hall Institute of Medical Research, Professor Doug Hilton, welcomed the announcement saying that the government's decision had removed a significant barrier to the community and that government support that would be required for the proposed $20 billion fund to be realised.

"I encourage federal MPs and senators to reach agreement on the proposed funding model for the Medical Research Future Fund," said Hilton, who is also president of the Association of Australian Medical Research Institutes and a member of the MRFF Action Group.

"The current funding structure for medical research has not been able to support the full potential of our research workforce, and for many years we have been telling governments that stronger investment is required. I congratulate the Australian government on having the courage to take a bold approach to improving how research is funded," he said.

Independent analyses have demonstrated that investment in Australian health and medical research results in long-term economic savings, with a return of at least $2 on every $1 invested in research.

GenePharma appoints Sapphire Bioscience as ANZ distributor

Sapphire Bioscience has been appointed as the exclusive distributor of GenePharma products in Australia and New Zealand. GenePharma is a Shanghai-based company that specialises in the synthesis of RNAi including siRNA, miRNA and related products.

With decades of experience in research and RNA synthesis, GenePharma scientists utilise state-of-the-art technologies to synthesise and label custom oligos. The company's portfolio also includes a selection of plasmid vectors and RT-PCR reagents.

The partnership with Sapphire Bioscience aims to provide local researchers with an affordable option for high-quality RNAi and related reagents.

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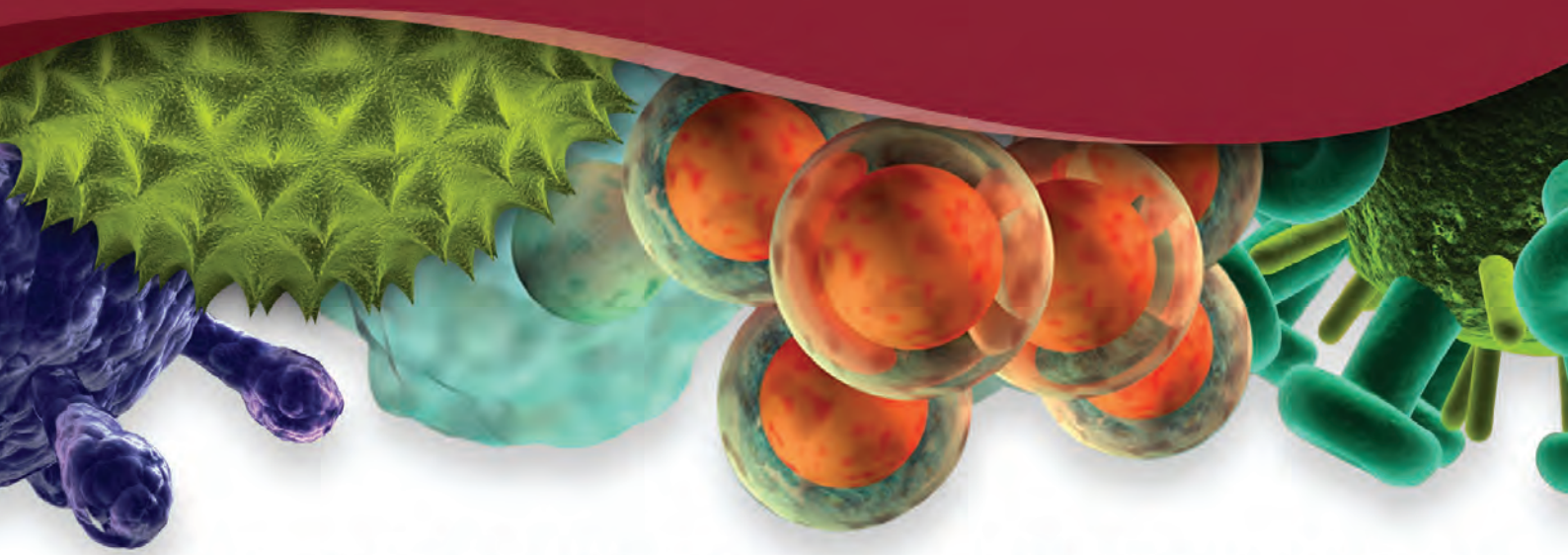

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Close encounters of a comet kind

Rosetta and Philae's scientific payloads

In March 2004, the spacecraft Rosetta was launched by the European Space Agency - its mission to orbit and land on the comet 67P/Churyumov-Gerasimenko. To complete the most detailed study of a comet ever attempted, the orbiter carried 11 science experiments and its lander, Philae, carried 10 additional instruments.

During its trek to Comet 67P/Churyumov-Gerasimenko, Rosetta completed three flybys of the Earth and one of Mars and made two excursions to the main asteroid belt that lies between the orbits of Jupiter and Mars. Then, after a 10-year journey through the solar system, the spacecraft arrived at the comet on 6 August 2014. Between August and November, the spacecraft orbited the comet and gathered data to characterise the environment and the comet nucleus. Then, on 12 November 2014, Rosetta's lander, Philae, was deployed to the surface.

Rosetta orbiter instruments

There are 11 instruments on board the Rosetta orbiter. Each was provided and administered by teams from institutes across the world. The suite of instruments comprises cameras, spectrometers, magnetometers and sensors, and each has its own specific needs that must be balanced to maximise the overall science return.

- ALICE - ultraviolet imaging spectrometer - will analyse gases in the comet's coma and tail and will measure the production rates of water and carbon monoxide/dioxide. It will also provide information on the surface composition of the nucleus.
- CONSERT - Comet Nucleus Sounding Experiment by Radiowave Transmission - will probe the comet's interior by studying radio waves that are reflected and scattered by the nucleus. The experiment has elements on both the Rosetta and Philae.
- COSIMA - Cometary Secondary Ion Mass Analyser - will analyse the characteristics of dust grains emitted by the comet, including their composition and whether they are organic or inorganic.
- GIADA - Grain Impact Analyser and Dust Accumulator - will measure the number, mass, momentum and velocity distribution of dust grains coming from the nucleus and from other directions (reflected by solar radiation pressure).
- MIDAS - Micro-Imaging Dust Analysis System - will study the dust environment around the asteroids and comet. It is designed to provide information on particle population, size, volume and shape.
- MIRO - Microwave Instrument for the Rosetta Orbiter - will be used to determine the abundances of major gases, the surface outgassing rate and the nucleus subsurface temperature. It will also measure the subsurface temperature of the comet nucleus to depths of several centimetres or more using the continuum channels at millimetre and submillimetre wavelengths.
- NAVCAM - the Rosetta Navigation Camera is a part of the Rosetta Attitude and Orbital Control System (AOCS). It comprises two identical cameras to provide for complete redundancy and single event upset (SEU). The purpose of the NAVCAM system is to provide imaging, autonomous acquisition and tracking of star-fields and extended sources, and autonomous navigation for the Rosetta spacecraft.
- OSIRIS - Optical, Spectroscopic and Infrared Remote Imaging System - a wide-angle camera and a narrow-angle camera that will obtain high-resolution images of the comet's nucleus and Rosetta's flyby targets. OSIRIS data will be used to help identify the best landing sites for Philae.
- ROSINA - Rosetta Orbiter Spectrometer for Ion and Neutral Analysis - contains two sensors which will determine the composition of the comet's atmosphere and ionosphere, the velocities of electrified gas particles and reactions in which they take part. It will also investigate possible asteroid outgassing.
- RPC - Rosetta Plasma Consortium - in this instrument, five sensors measure the physical properties of the nucleus, examine the structure of the inner coma, monitor cometary activity and study the comet's interaction with the solar wind.
- RSI - Radio Science Investigation - shifts in the spacecraft's radio signals are used to measure the mass, density and gravity of the nucleus, to define the comet's orbit and to study the inner coma. RSI will also be used to study the solar corona during the periods when the spacecraft, as seen from Earth, is passing behind the Sun.
- VIRTIS - Visible and Infrared Thermal Imaging Spectrometer - will map and study the nature of the solids and the temperature on the surface of the nucleus. Comet gases will be identified and the physical conditions of the coma will be characterised, helping to identify the best landing sites for Philae.

As a general rule, the instruments that collect gas and dust usually want to point directly down at the nucleus of the comet. These include COSIMA, GIADA, MIDAS and ROSINA. The RPC instrument, a collection of in-situ plasma and wave sensors, also has specific pointing requirements.

The remote-sensing experiments are more varied. Depending on the investigation, they sometimes want to point straight down at the nucleus, sometimes at the limb, sometimes out towards the coma - the gas and dust environment surrounding the nucleus. Alice, OSIRIS, MIRO and VIRTIS are like this.

Not fitting directly into these classifications are RSI and CONSERT. RSI uses the high gain antenna of the spacecraft directly for its science, so any pointing constraints are dictated by the spacecraft operations. The CONSERT experiment comprises a radio antenna on the lander and one on the orbiter, to perform tomography of the comet nucleus. Science operations with CONSERT require the transmission of radio signals between these antennae, through the body of the comet.

Philae lander

The ~100 kg Rosetta Lander, Philae, is the first spacecraft ever to make a soft landing on the surface of a comet nucleus. The box-shaped lander was carried in piggyback fashion on the side of Rosetta until it arrived at Comet 67P. Once Rosetta was aligned correctly, the ground station commanded Philae to self-eject from the main spacecraft and unfold its three legs, ready for a gentle touchdown at the end of the ballistic descent. On landing, the legs had been designed to damp out most of the kinetic energy to reduce the chance of bouncing, and they can also rotate, lift or tilt to return the Lander to an upright position.

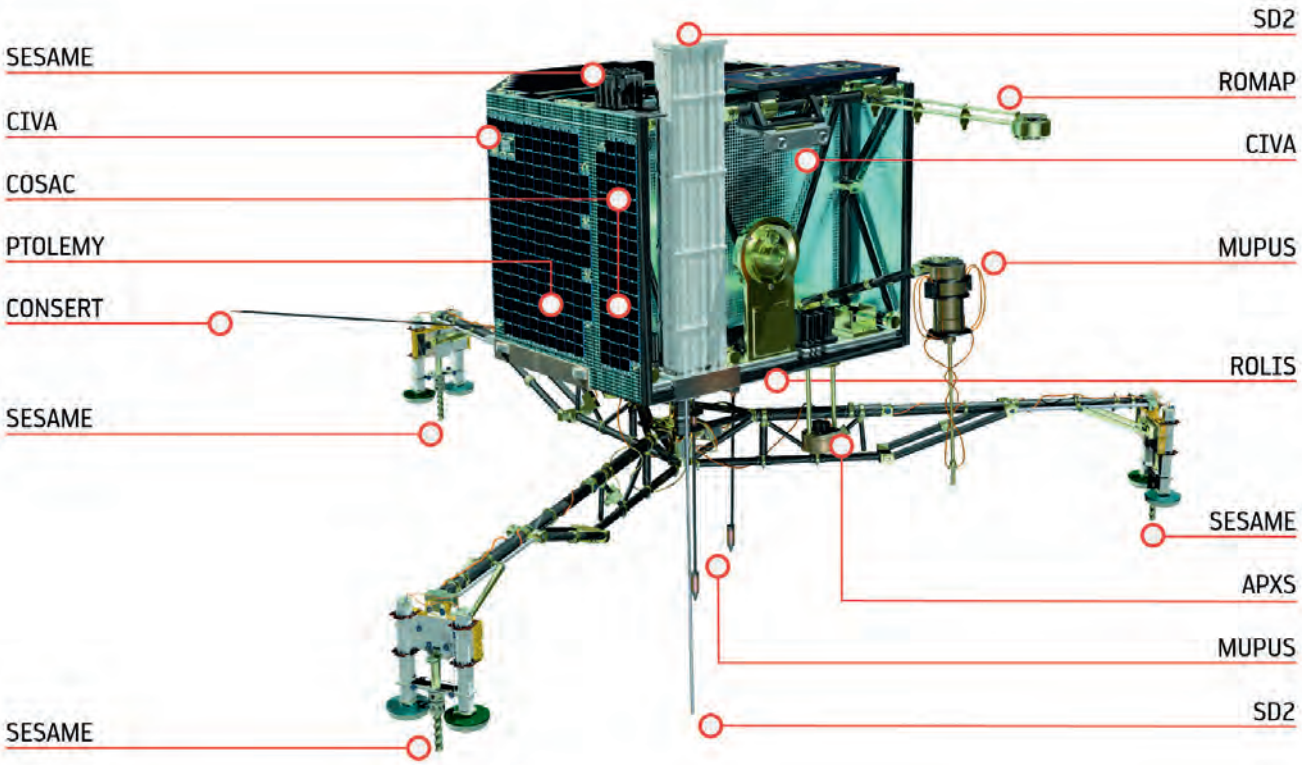
Immediately after touchdown, a harpoon was to have been fired to anchor Philae to the ground and prevent it escaping from the comet's extremely weak gravity. The minimum mission target for scientific observations was one week, but it was hoped that the surface operations would continue for many months.

After being released from the Rosetta orbiter, the lander actually bounced off Comet 67P/Churyumov-Gerasimenko twice before coming to its current less-than-ideal resting spot.

Sadly, the lander's planned mission ended after about 64 hours when its batteries ran out because of the low sunlight conditions. Although Philae went into hibernation after about 57 hours, it had already beamed back a wealth of science, delivering a full set of results that are now being analysed by scientists across Europe.

While it will take scientists a while to sift through the data collected by Philae, it looks like the probe has sent home some interesting new results. Before shutdown, one of Philae's instruments managed to 'sniff' the first organic molecules detected in the atmosphere of the comet, officials with the DLR German Aerospace Center said. However, scientists still aren't sure what kind of organics - carbon-containing molecules that are the building blocks of life on Earth - were found.

Philae also found that Comet 67P/C-G's surface is harder than researchers initially thought it would be. Before the probe's battery ran out, Rosetta mission controllers commanded Philae to hammer into the



surface of the comet and found that the cosmic body is probably as hard as ice, according to ESA.

"Although the power of the hammer was gradually increased, we were not able to go deep into the surface," research team leader Tilman Spohn, of the DLR Institute of Planetary Research, said in a statement. "We have acquired a wealth of data, which we must now analyse."

An instrument onboard Rosetta has also recently made an important discovery for scientists interested in the composition of the comet's ice and its potential implications for how Earth became a watery world.

Mission controllers on Earth commanded Philae to drill into the surface of the comet just after it came to rest in its final landing spot, but officials aren't sure exactly how much comet material was collected by the instrument.

ESA officials are still hopeful that Philae could get in touch again as Comet 67P/C-G makes its way around the sun. It's possible that the sunlight and temperature conditions around the lander could change as the comet gets closer to our star, allowing Philae to potentially come back to life.

Instruments on Philae

The lander experiments were designed to study the composition and structure of Comet 67P/Churyumov-Gerasimenko's nucleus.

The instruments were designed to:

- measure the elemental, molecular, mineralogical and isotopic composition of the comet's surface and subsurface material;
- measure characteristics of the nucleus such as near-surface strength, density, texture, porosity, ice phases and thermal properties; texture measurements will include microscopic studies of individual grains.

The lander structure consists of a baseplate, an instrument platform and a polygonal sandwich construction, all made of carbon fibre. Some of the instruments and subsystems are beneath a hood which is covered with solar cells. An antenna transmits data from the surface to Earth via the orbiter.

APXS - Alpha X-ray Spectrometer

The goal of the Rosetta Alpha Proton X-ray Spectrometer (APXS) experiment is the determination of the chemical composition of the landing site and its potential alteration during the comet's approach to the Sun. The data obtained will be used to characterise the surface of the comet, to determine the chemical composition of the dust component and to compare the dust with known meteorite types. These results will be brought into context with other measurements made on the lander and the orbiter to fully obtain a more complete picture of the present state of the comet, and to draw conclusions on its evolution and origin.

Lowered to within 4 cm of the comet surface, APXS will detect alpha particles and X-rays, which will provide information on the elemental composition of the comet's surface.

CIVA

Six identical micro-cameras take panoramic pictures of the surface. A spectrometer studies the composition, texture and albedo (reflectivity) of samples collected from the surface.

CONSERT

CONSERT (COmet Nucleus Sounding Experiment by Radio-wave Transmission) is a complex experiment that will reveal the internal structure of a comet nucleus for the very first time. Instrument components are found on both the orbiter and the lander, the idea being to establish a radio link that passes through the comet nucleus. The way in which the radio waves propagate through the nucleus will give scientists clues as to its structure and nature.

CONSERT will examine many properties of the comet nucleus, such as:

- its mean electrical properties: this will allow scientists to broadly characterise the types of materials present;
- the correlation length: this is a measure of the average size of the substructures or 'Cometesimals' that have collected together to form the nucleus;
- the number and thickness of the various layers or interfaces present beneath the surface;
- its overall structural homogeneity: this will allow scientists to determine whether the nucleus is a single uniform body or if it is a mixed collection of smaller bodies, more akin to a rubble pile.

After analysis, the CONSERT data will allow

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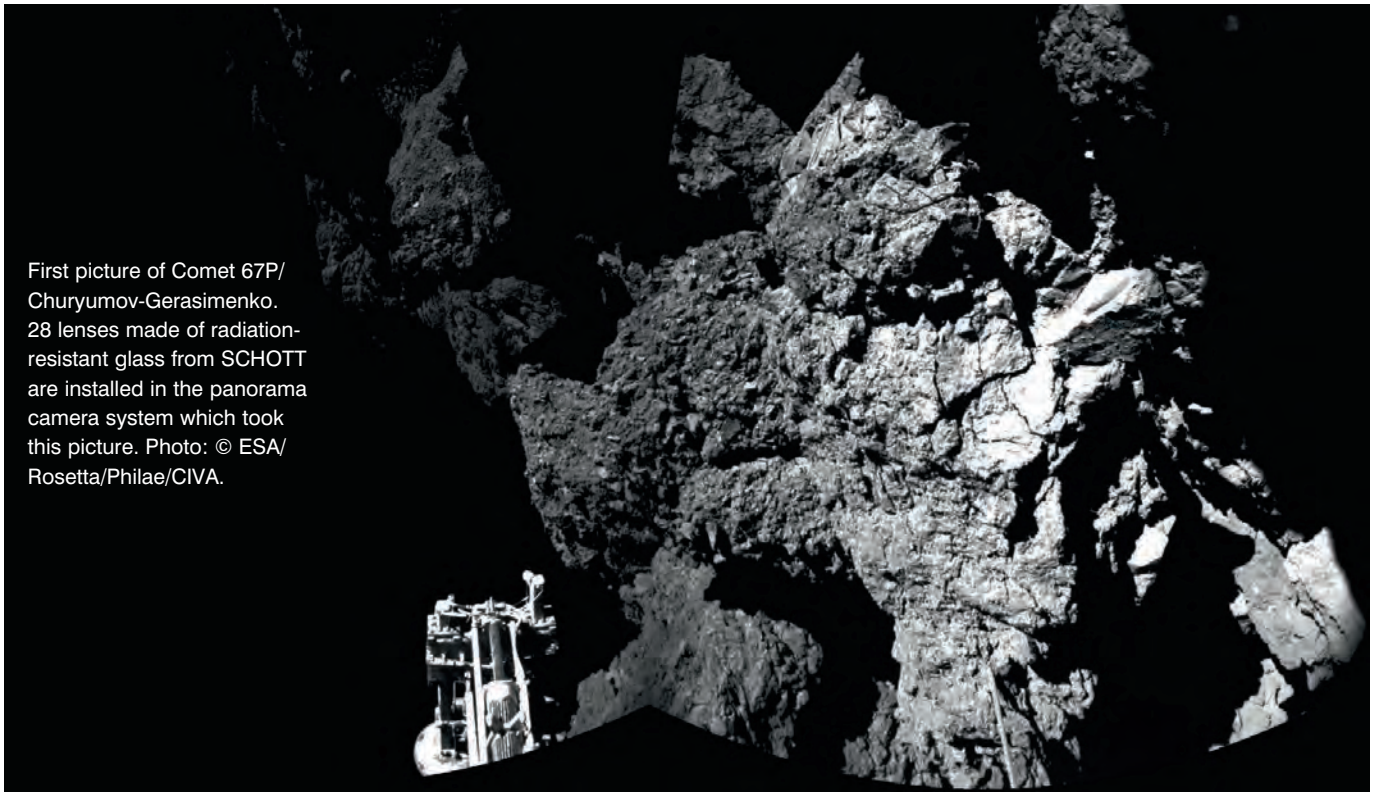

First picture of Comet 67P/ Churyumov-Gerasimenko. 28 lenses made of radiation-resistant glass from SCHOTT are installed in the panorama camera system which took this picture. Photo: © ESA/ Rosetta/Philae/CIVA.

scientists to build up a detailed structural view of the comet nucleus, which will in turn constrain scenarios on how it was formed. The origin of the comet is closely linked to the conditions in the Primitive Solar Nebulae some 4600 million years ago. CONSERT will therefore play a vital role in fulfilling Rosetta's objective to further our understanding of the origin and formation of the solar system.

COSAC

The COmetary SAmpling and Composition experiment COSAC is one of the two 'evolved gas analysers' (EGAs) onboard the Rosetta-Lander. Whereas the other EGA, Ptolemy, aims mainly at accurately measuring isotopic ratios of light elements, the COSAC is specialised in detection and identification of complex organic molecules.

MUPUS

The scientific objectives of MUPUS (MUlti-PUrpose Sensors for Surface and Sub-Surface Science) are: to understand the properties and layering of the near-surface matter as these evolve with time as the comet rotates and approaches the Sun; to understand the energy balance at the surface and its variation with time and depth; to understand the mass balance at the surface and its evolution with time; and to provide ground truth for thermal mapping from the Orbiter, and to support other instruments on the Rosetta Lander (eg, SESAME-CASSE).

PTOLEMY

Ptolemy is the first example of a new concept in space instrumentation, which has been devised to tackle the analytical challenge of making in situ isotopic measurements of solar system bodies. The instrument concept is termed MODULUS, which is taken to mean Methods Of Determining and Understanding Light elements from Unequivocal Stable isotope compositions.

The scientific goal of the MODULUS concept is to understand the geochemistry of light elements, such as hydrogen, carbon, nitrogen and oxygen, by determining their nature, distribution and stable isotopic compositions.

The size of a small shoe box and weighing less than 5 kg, Ptolemy will use gas chromatography/mass spectrometry (GCMS) techniques to investigate the comet surface and subsurface.

ROLIS

The descent and down-looking ROLIS Camera (ROsetta Lander Imaging System) will deliver first close-ups of the environment of the landing place of comet 67P/Churyumov-Gerasimenko during the descent. A CCD camera will obtain high-resolution images during descent and stereo panoramic images of areas sampled by other instruments.

After landing ROLIS will make high-resolved investigations to study the structure (morphology) and mineralogy of the surface.

ROMAP

The ROsetta Lander Magnetometer and Plasma Monitor (ROMAP) is a multisensor experiment. The magnetic field is measured with a fluxgate magnetometer. An electrostatic analyser with integrated Faraday cup measures ions and electrons. The local pressure is measured with Pirani and Penning sensors. The sensors are situated on a short boom. The deployment on the surface of a cometary nucleus demanded the development of a special digital magnetometer of little weight and small power requirements. For the first time a magnetic sensor will be operated from within a plasma sensor. A prototype of the magnetometer, named SPRUTMAG, was flown on space station MIR.

SD2

The sampling, drilling and distribution (SD2) subsystem will provide microscopes and advanced gas analysers with samples collected at different depths below the surface of the comet. Specifically, SD2 can bore up to 250 mm into the surface of the comet and collect samples of material at predetermined and/or known depths. It then transports each sample to a carousel, which feeds samples to different instrument stations: a spectrometer, a volume check plug, ovens for high and medium temperatures and a cleaning station. SD2 will be accommodated on the flat ground-plate of the Rosetta, where it will be exposed to the cometary environment.

SESAME

In SESAME (Surface Electrical, Seismic and Acoustic Monitoring Experiments) three instruments will investigate the comet's outer layers. A cometary acoustic sounding surface experiment will measure the way sound travels through the surface; a permittivity probe will look at its electrical characteristics; and a dust impact monitor will measure dust falling back.

The results of SESAME will help in understanding how comets, have formed and thus, how the solar system, including the Earth, was born.

Biofilm detection in real time

The presence of biofilms on surfaces within food and beverage processing areas is a serious potential cause of contamination of the final product. Biofilms can be caused by bacteria including *Listeria*, *Salmonella*, *E. coli* and *Staphylococcus*, among others.

Biofilms are invisible to the naked eye, but now they can be detected quickly and efficiently. Itram Higiene has developed BioFinder, a product for the detection of biofilms in open surfaces and an effective tool for hygiene monitoring. The biofilm detection spray reacts in the presence of biofilms, so the user can easily visually identify if biofilm exists through a clear reaction to the product.

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Particle measurement system

ATA Scientific recently installed the first Morphologi G3-ID in Australia at Southern Cross University (SCU) within the School of Science, Environment and Engineering. The instrument is intended to be used primarily by researchers and students at SCU and other research institutions to support cutting-edge research involving environmental particles. The instrument will also be available for external commercial work.

Rapid and accurate characterisation of different particles in a sample is seen as a challenge as traditional manual microscopy methods have shown to be both subjective and time-consuming. Automated image analysis systems provide a means for improved statistical classification of particles, enabling differentiation based on their size and morphological parameters.

The Morphologi G3-ID, from Malvern Instruments, can accurately measure particles in the range of 0.5 to 1000 μm. An integrated dry powder dispersion system automates sample preparation for repeatable and reproducible measurements of a wide range of samples. When equipped with a Raman microprobe, the product gains the additional ability to chemically identify particles enabling the differentiation of chemical components within a blend and the identification of foreign contaminants.

The instrument will be available for collaborative work with researchers from other research institutions and for commercial work through the university's Environmental Analysis Laboratory (EAL).

ATA Scientific Pty Ltd
www.atascientific.com.au

Meter range

Horiba's LAQUAtwin meter range allows measurements of critical parameters in water and food to be tested accurately and have results available within seconds.

Incorporated into the unit is a flat sensor that requires only a few drops of calibration solution or sample to take a measurement. The sensor allows for easy measurement of hard-to-test samples such as powders and food matrices.

The device can be used in most environments as it is waterproof (IP67) and dustproof. Models are currently available to test the following parameters: pH; conductivity; sodium ion; potassium ion; nitrate ion; calcium ion; salt.

Arrow Scientific

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RT-PCR kit for *Ebolavirus*

The altona Diagnostics RealStar Ebolavirus RT-PCR Kit 1.0 is a reverse transcription polymerase chain reaction (RT-PCR) test intended for the qualitative detection of RNA from all known strains of ebolaviruses, including the Zaire strain driving the current Ebola epidemic in West Africa. The kit is authorised for emergency use on specified instruments in plasma from individuals with signs and symptoms of ***Ebolavirus*** infection in conjunction with clinical and epidemiological risk factors.

It has been authorised by the FDA under an Emergency Use Authorization for use by CLIA High Complexity Laboratories and similarly qualified non-US laboratories and only for the detection - not differentiation - of RNA from ebolaviruses (such as ***Zaire ebolavirus***, ***Sudan ebolavirus***, ***Tai Forest ebolavirus***, ***Bundibugyo ebolavirus*** and ***Reston ebolavirus***) and not for any other viruses or pathogens. The test is only authorised for the duration of the declaration that circumstances exist justifying the authorisation of the emergency use of in vitro diagnostics for detection of ***Zaire ebolavirus***.

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Benchtop homogeniser for RNA/DNA and protein isolation

The FastPrep-24 5G high-speed benchtop homogeniser offers both speed and performance for the lysis of biological samples. It can be used for the simultaneous homogenisation of up to 24 samples in 40 s.

The instrument uses an optimised motion to disrupt cells through the multidirectional, simultaneous beating of specialised Lysing Matrix beads on the sample material. Developed for difficult and resistant samples, the FastPrep-24 5G lyses thoroughly and quickly any tissues and cells and thus allows easy and reproducible isolation of stable RNA, active proteins and full-length genomic DNA.

The touch screen, software-based interface includes a wide range of predefined programs designed for optimal setting of routinely run sample types.

The homogeniser features nine interchangeable adapters enabling versatility in sample number, size and temperature conditions. All optional adapters stand stable on the benchtop and are commonly used as tube racks for sample storage at -20 or -80°C. Frozen Lysing Matrix tubes loaded in the adapters are ready to be immediately processed in the FastPrep-24 5G with minimal hands-on manipulation.

A wide range of specialised Lysing Matrix tubes containing beads of different materials, sizes and shapes have been tailored to ensure thorough homogenisation of any sample. High-performance purification kits, when used in conjunction with the FastPrep-24 5G, provide simple, ready-to-use methods for the release and subsequent purification of DNA, RNA and proteins.

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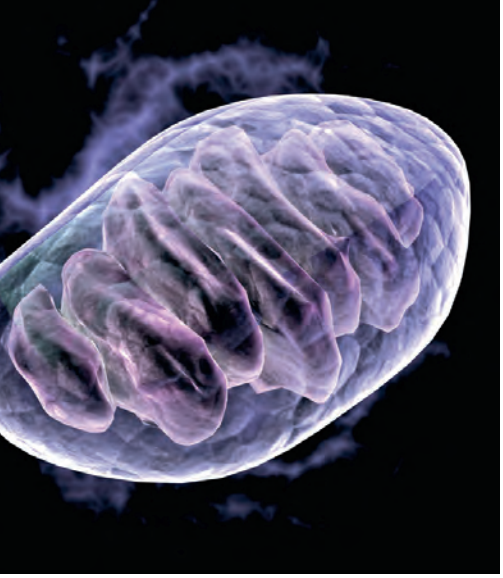

High-throughput assays for mitochondrial function

Enzo Life Sciences' Mito-ID assays work together to assess the dynamic interaction between mitochondrial respiration and glycolytic flux.

Mito-ID Oxygen and pH Sensors are high-throughput assays with easy mix-and-measure protocols. The sensitive, reversible probes provide real-time analysis and are compatible with standard fluorescence plate readers.

Mito-ID Extracellular O_2 Sensor Kits are oxygen-sensitive phosphorescent probes which can be used to assess O_2 consumption by cultured cells, isolated mitochondria, microorganisms, tissues and enzymes. The probe increases in signal intensity with O_2 consumption.

The Mito-ID Extracellular pH Sensor Probe is a pH-sensitive phosphorescent probe which can be used to monitor cellular acid extrusion. It provides a simple mix-and-read protocol for 96-well microplates and is amenable to standard fluorescence plate readers (Ex/Em 340/615 nm).

The Mito-ID Membrane Potential Cytotoxicity Assay Kit is a real-time mitochondrial membrane potential assay, said to be 10x more sensitive than JC-1 with good aqueous solubility. The product features photostable dual-emission dye and no-wash/no-medium removal. It is suitable for high-throughput applications; separate Mito-ID Red/Green assays are available for the detection of mitochondrial mass.

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www.unitedbioresearch.com.au

Next-generation sequencing system

Thermo Fisher Scientific has announced the Ion PGM Dx System, developed using Ion Torrent next-generation sequencing (NGS) technology.

The product enables clinical laboratories to more easily develop and implement next-generation sequencing diagnostic assays. Providing accurate genetic variant analysis with as little as 10 ng of sample DNA, the system is suitable for the clinical and diagnostic communities.

The system includes the instruments, GMP reagents and software controls necessary to establish high-performing next-generation clinical sequencing workflows.

Thermo Fisher Scientific
www.thermofisher.com.au

Adjustable-volume dispenser bottles

The Kartell range of plastic labware includes a variety of Adjustable Volume Dispenser Bottles.

The bottles are made of polyethylene (PE), which is suitable for chemical liquids and foodstuffs. The measuring container is made from polymethylpentene (PMP), which is highly translucent for accurate measuring. The dispenser bottles come in 250, 500 and 1000 mL capacities, while the measuring container comes in 25 and 50 mL capacities.

The graduated clear PMP measuring cup slides up and down the tube and the variation in height changes the volume to be dispensed. The dispensed volume remains constant at any preset position of the cup. The cup is filled by squeezing the bottle and forcing the liquid up the tube. When the bottle pressure is released, the excess will be drawn back into the bottle and only the desired volume will remain.

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

Demonstration hood

Hemco's Classroom Demonstration Hood is suitable for classroom experiments and demonstrations because of its viewing visibility from all four sides. An instructor can perform a science demonstration while the class can gather around and safely observe. The hood can also be used as an individual student workstation or vented storage enclosure.

A hinged viewing window or optional horizontal sliding glass panels allow for easy access and user safety. An integral exhaust blower safely exhausts fumes and odours. A vapour-proof light is factory installed. A wide selection of accessories, including tables and ducting, is also available for the user's specific needs.

HEMCO Corporation
www.HEMCOcorp.com

Filtration safety cabinet

The LABOPUR 12X series is a safety cabinet for safe storage in laboratories and working premises without duct infrastructure. The cabinet features 15/10 steel doors covered with white epoxy and blue stripes.

The large glazed doors allow chemicals to be easily recognised while safely locked away. The cabinet also features four perforated shelves adjustable in height and extractable retention tanks.

The specially engineered active coal technology used in the filter provides high efficiency and has been tested and approved according to Norm NFX 15-211. The safety cabinet will protect staff, laboratory technicians, students and the environment from toxic fumes.

Due to its low energy consumption, the cabinet only requires a filter change every 10 to 12 months and uses less than 500 kWh/yr. The vertical compartment architecture allows segregated and secure storage, providing storage for a variety of chemicals in one convenient place.

Due to its filter technology, the cabinet can be used anywhere that safe storage is required for hazardous chemicals. LabFriend also carries a range of filters to suit a number of applications.

LabFriend
www.labfriend.com.au

Image analysis software

Image-Pro Premier image analysis software from Media Cybernetics offers intuitive tools that make it easy to capture, process, enhance, measure, compare, analyse, automate and share images and valuable data. The Image-Pro Premier v9.1 offers both 32- and 64-bit support, a user-friendly interface, intuitive macros and app building tools, improved ways to automatically segment, classify and measure objects, and more tools for customising workflow.

The image analysis software enables users to acquire either rapid events or experiments that last for long periods of time. The software is not only able to use the memory (RAM) available on the host computer, but it can also stream multi-gigabyte movies directly to the hard drive. The software is suitable for microscopists in many disciplines.

SciTech Pty Ltd
www.scitech.com.au

Automated operation of real-time PCR instruments

Bio-Rad Laboratories has announced the CFX Automation System II, a robotic plate handler that enables high-throughput, walk-away, real-time PCR automation for all Bio-Rad CFX Real-Time PCR Detection Systems. The system can meet the high-throughput, real-time PCR requirements of today's drug discovery and screening workflows by facilitating hands-off, around-the-clock data generation and analysis.

The product can be integrated with one or two CFX systems while maintaining a small footprint and includes easy-to-use software that makes automation accessible to all researchers. It is easily integrated with laboratory information management systems (LIMS) to facilitate sample tracking, save time and minimise human error.

The unit allows laboratories to operate two CFX systems with a single plate handler using a fraction of the space required by other systems. By beginning with one real-time system and scaling up to two systems when required, researchers can meet changing throughput demands. The software also allows for easy integration of wet-lab validated PrimePCR assays.

Bio-Rad Laboratories Pty Ltd
www.bio-rad.com

AppNotes

Rapid and thorough DNA, RNA and protein extraction

The FastPrep-24 5G high-speed benchtop homogeniser is an ultrahigh-performance sample preparation system that allows for the extraction of fully intact, biologically functional macromolecules from routine as well as highly resistant samples.

The high-speed benchtop homogeniser can be used for grinding, lysing or homogenising - facilitating the easy and reproducible isolation of stable RNA, active proteins and full-length genomic DNA. Applications include but are not limited to all types of human, animal and plant tissues including cultured cells; bacterial, yeast and fungal cells, including spores and oocytes; environmental and metagenomic samples including soil and faecal samples; and other inorganic solid matrices.

The intuitive software, microprocessor control and high-definition touch screen programming features in the FastPrep-24 5G ensure that optimisation time is minimised so users have more time to analyse data.

The FastPrep-24 5G uses a unique, optimised motion to disrupt cells through the multidirectional, simultaneous beating of specialised Lysing Matrix beads on the sample material. Samples and buffers are added to Lysing Matrix Tubes containing the beads, supplied ready to use, certified nuclease-free and in a variety of sample type specific compositions.

The instrument lyses thoroughly and quickly any tissues and cells and thus allows easy and reproducible isolation of stable RNA, active proteins and full-length genomic DNA.

The sample tubes remain securely sealed during the processing and the single-use design eliminates cross-contamination. Program parameters are easily set using the touch screen user interface, or users can choose from the 70-plus recommended programs, user-defined saved programs or user-defined custom programs stored on the 5G's onboard computer.

The recommended programs are the heart of the 5G's functionality. These validated programs include all variable assay parameters. This is a valuable optimisation tool for new users and is of special interest to those who are working with pathogenic or dangerous samples, as well as low abundance samples.

FastPrep will homogenise up to 24 samples in 2 mL tubes or, with optional adapters, lyse 48 samples in 2 mL tubes, 24 samples in 4.5 mL tubes, 12 samples in 15 mL tubes or 2 samples in 50 mL tubes making FastPrep a particularly versatile homogeniser. Developed for difficult and resistant samples, FastPrep-24 thoroughly and quickly lyses all tissues and cells providing easy and reproducible isolation of stable RNA, active proteins and full-length genomic DNA.

- Powerful: The highest speed available (10 m/s) provides the thorough grinding, homogenising and lyses of the most difficult samples in just a few seconds.
- Highest yield and purity: The most DNA, RNA and proteins from any sample type including the most resistant samples. FastPrep-24 5G with FastPrep Kits provide the highest yield and purity. Programmed protocols.
- Intuitive: Interactive user-friendly interface and touch screen for easy programming and numerous, >70, recommended pre-programmed protocols for a large variety of applications.
- Complete solution: Largest number of ready-to-use Lysing Matrix compositions and FastPrep Kits for DNA, RNA and protein purification of any sample and tissue application.
- Flexible: Easily interchangeable adapters to process any sample size (2, 4.5, 15 or 50 mL tubes) at cryogenic or room temperature. Up to 48 samples can be processed at one time under ambient or cryogenic conditions.

The NextGen Sample Prep delivers the most DNA, RNA and proteins from the most resistant samples in 40 seconds or less.

MP

www.mpbio.com

BioResearch

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Life science conference season in Lorne

Throughout February the beautiful Victorian coastal town of Lorne will host a series of conferences that will be of interest to all life scientists.

Local, national and international speakers will appeal to scientists attending the various conferences while the location with beaches, golf courses, tennis and bushwalking will keep their whole families entertained.

Now your only decision is to choose which events you want to attend.

The 20th Annual Lorne Proteomics Symposium: 5-8 Feb 2015

The 20th Lorne Proteomics Symposium presents the latest developments in proteomics technologies at Mantra Lorne in Lorne, Victoria, from 5-8 February.

Invited internationally recognised speakers will focus on themes that span not only core technologies in proteomic chemistry, but also tools for the interpretation of proteomics output that allow researchers to answer fundamental questions in biology. www.australasianproteomics.org.au

The 40th Lorne Conference on Protein Structure and Function: 8-12 Feb 2015

The 40th birthday of the Lorne Conference on Protein Structure & Function promises to be a very special meeting with many highlights in the making, including a presentation by Nobel Laureate Dr Venki Ramakrishnan. The program will feature premier sessions on imaging complex systems, protein engineering, regulation and research highlights from around the country that will be of interest and relevance. Attendance is anticipated to be over 400 delegates. www.lorneproteins.org

The 27th Lorne Cancer Conference: 12-14 Feb 2015

The Lorne Cancer Conference has a long and successful history of delivering a great ambience and vibrancy. With a strong international and national scientific content, it attracts a capacity audience of over 500 delegates. These delegates represent many of the major hospitals, universities, research institutes and biotechnology companies within Australia. Confirmed plenary speakers include Prof Mark Smyth, Prof Ivan Oransky and Prof Yardena Samuels. www.lornecancer.org

The 36th Annual Lorne Genome Conference: 15-18 Feb 2015

Lorne Genome is Australia's foremost conference on the organisation and expression of the genome. The confirmed line-up of international invited speakers is exciting and will once again draw national and international delegates to this popular meeting.

This meeting has continued to build over the years and we anticipate attracting around 400 delegates in 2015. www.lornegenome.org

5th Lorne Infection and Immunity Conference: 18-20 Feb 2015

Lorne I&I is convened jointly by the Victorian Infection and Immunity Network (VIIN) and the Australian Infectious Diseases Research Centre (AID). VIIN and AID are internationally recognised hubs of excellence in immunity and microbiology. Together, they represent a network of over 7000 researchers and clinicians at universities, research organisations and hospitals in Victoria and Queensland. In 2015, confirmed international speakers include Eva Harris from University of California amongst many other internationally recognised experts. www.lorneinfectionimmunity.org

Centrifugal evaporator

Genevac's EZ-2 Elite centrifugal evaporator has been designed for final drying of stubborn samples and fast lyophilisation of HPLC fractions. Benefiting from a high-performance scroll pump that delivers deep vacuum, the product is able to routinely remove even high-boiling solvents such as DMSO and NMP.

Internal heating of vapour duct and system components ensures that such challenging solvents only collect in the SpeedTrap condenser and not anywhere else. The condenser comes with automatic defrost and drain technology. The evaporator controls the condenser and the solvent collection vessel, offering mid-method defrosting and draining. Using the SpeedTrap, the Genevac LyoSpeed method of fast lyophilisation of HPLC fractions is possible.

The product is able to concentrate or completely dry samples. It is compatible with a wide selection of sample holders, enabling evaporation from common sample container formats. The system is able to take tubes, flasks and vials directly from the synthesis process, eliminating manual handling, increasing recoveries and removing the chance of cross-contamination.

Running the product is intuitive: just load the samples, select maximum safe temperature for samples, select solvent type and hit start. Offering unattended operation capability, the unit requires no user training; even a beginner can competently use the system within 5 min.

Scitek Australia Pty Ltd
www.scitek.com.au

Durable microscope slide boxes

Microscope slide boxes from Heathrow Scientific are colour coded for easy identification. They are suitable for storage or transportation of standard size slides (76 x 26 mm) as they have a durable plastic outer case and are cork lined.

The stackable slide boxes are secured either with a rust-resistant, nickel-plated clasp and hinge pin (100 place) or by a thumb-latch lock mechanism (50 place). Each slot is numbered to correspond to the slide inventory sheet on the inside cover of the box. They are suitable for any laboratory and can be used for any application that involves slides.

LabFriend
www.labfriend.com.au

Ergonomic pipette

Vistalab has introduced the Ovation M Pipette. The small, manual pipette features a low-force plunger for ease of use; adjustable handle to fit any-sized hand; quick and easy volume setting; standing unit to prevent contamination from lying on benchtops; and a tip acquisition and release mechanism that requires minimal force.

The design of the range of pipettes promotes an ergonomically correct posture to relieve or prevent repetitive-stress-related injuries. The pipettes are available in sizes from 0.2 to 1000 μL.

Interpath Services Pty Ltd
www.interpath.com.au

Protein charge and k_D measurement

Wyatt Technology has released the Möbius, a product which simultaneously measures protein charge and diffusion interaction parameter (k_D) to determine the colloidal stability of two formulations with different long-term stability behaviour. It uses massively parallel phase-analysis light scattering (MP-PALS) in conjunction with an autosampler to automate the measurement.

Both charge and k_D are important parameters to indicate colloidal stability, since charge alone may not provide a complete picture: molecules can have a favourable net charge though be destabilised by localised factors such as charge asymmetry and hydrophobic residues. The product can combine the measurement of charge and k_D of monoclonal antibodies in parallel. It is thus suitable for protein characterisation and provides a complete picture of factors affecting a protein's stability.

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

Protein solubility screening kits

OptiSol protein solubility kits from DiLYX are plate-based arrays designed for screening protein stability and buffer optimisation. The kits can be used with proteins from 5 to 300 kDa, identifying formulations which prevent aggregation or are able to de-aggregate specific proteins.

Proteins often aggregate when exposed to elevated temperature, intense light, freeze-thaw cycles and extended storage. The kits contain a systematically varied array of buffers (from pH 3 to pH 10) and a series of solubility enhancers (salts, amino acids, sugars, polyols, reducing reagents) that elucidate the conditions which prevent aggregation, or are able to de-aggregate proteins. A total of 90 different formulations with solubility enhancers can be tested in one single, label-free experiment.

The kits follow a simple mix-and-spin protocol that can be completed in under 2 h and require low sample input (less than 10 μL for each protein solubility data point). The kit is compatible with many functional assays, SDS-PAGE, Western blot, mass spectrometry and fluorescence-based protein.

There are two kits available, depending on the user's target protein: OptiSol 30, for proteins 5 to 50 kDa; and OptiSol 200, for proteins 50 to 300 kDa.

Sapphire Bioscience
www.sapphirebioscience.com

Shaking incubator

Temperature equipment manufacturer Labnet introduces the AccuTherm Shaking Incubator to its range. The temperature-controlled vortexer uses Peltier technology to rapidly cool samples. By combining heating/cooling with mixing technologies, it is suitable for a wide range of applications in molecular biology, biochemistry and clinical chemistry fields.

The instrument is easy to use, offering an intuitive control panel along with a multicolour display, allowing users to program and monitor temperature, time and speed settings in real time. The product offers a temperature setting range of 0-105°C, with the flexibility of eight interchangeable aluminium blocks suitable for PCR plates as well as tubes ranging in size from 0.02 to 15 mL. The device has a compact footprint and is suitable for the busy demands of today's lab.

Pacific Laboratory Products
www.pacificlab.com.au

Solvent recycler

The gel permeation chromatography solvent recycler B/R 9600, from BR Instructions, enables users to save money and the environment. The product can recycle TCB (trichlorobenzene), HFIP (hexafluorolsopropanol), n-methylpyrolidone, THF (tetrahydrofuran) and many more solvents.

The company also offers general lab equipment recyclers for solvents used for general purposes - such as glassware drying, extractions and chemical reactions - including acetone, methanol and dichloromethane.

Abacus ALS Australia
www.abacus-als.com

Cartridge system for GPC column protection

Phenomenex has extended its SecurityGuard family of products to include a cartridge-based system that protects any non-aqueous gel permeation chromatography (GPC) column. The cartridge system replaces traditional guard columns, offering a convenient system for protecting GPC columns from the damaging effects of contaminants and microparticulates. The cartridges are offered in three-packs.

The cartridge design enables the user to visually inspect the surface of the column's packing material at any time and monitor contaminant build-up. The visual inspection allows for cartridge changes at the right time to maintain optimal column protection and performance.

The product is compatible with any manufacturer's GPC column of any particle or pore size. It is easy to use and connects directly into the column without the use of additional fittings that can decrease column performance. The cartridges can even be double stacked for added protection.

Phenomenex Australia
www.phenomenex.com

Wireless monitoring solution

The Smart-Vue wireless monitoring solution safeguards the integrity of samples by continuously monitoring critical parameters of laboratory equipment and securely logging data. The product features audit trail traceability to assist with conformance to 21 CFR part 11 and other regulatory requirements. The unit has a temperature range of -200 to +350°C. Its applications include temperature, CO_2 concentration, relative humidity and differential pressure. It is compatible with laboratory and ultralow temperature circulators and chillers.

Rheology Solutions Pty Ltd
www.rheologysolutions.com

Pressure relief valve test bench upgrade

Nessco Pressure Systems (NPS) has upgraded two Hydratron Pressure Relief Valve Test Benches in order to comply with the stringent safety standards of the WA gas fields.

Both test benches were fitted with a custom-built safety cell specifically designed to fold completely away from the bench, allowing clear passage to load valves onto the test unit with either a front-on or overhead jib crane. The units were also installed with a dead-man foot valve, designed to prevent nitrogen gas flow when not activated.

The company's qualified technicians custom designed and manufactured in-house both the safety cells and foot valves in order to meet the expectations of the oil and gas industry. During the process, they also serviced the test benches, subjecting them to the Hydratron-defined factory acceptance test (FAT), providing a total turnkey package.

Nessco Group
www.nessco.com.au

Controlled-rate liquid nitrogen freezer

Sy-Lab's compact IceCube 11XS controlled-rate freezer features a cooling rate of 10°C/min and resolution of 0.01°C.

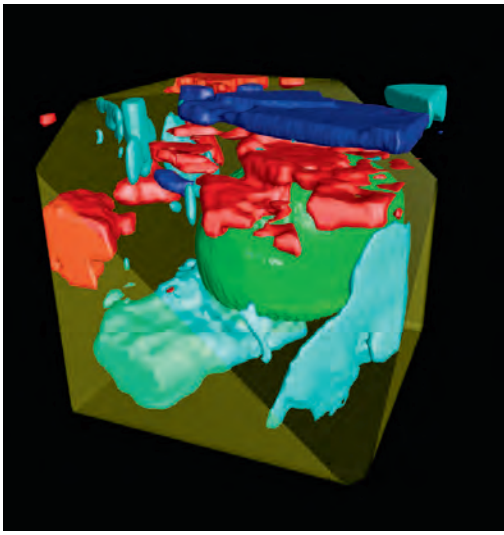
The freezer has a sample capacity of 36 x 2 mL vials, 18 x 5 mL vials or four straw holders. Control is via a 165 mm touch screen and data transfer is via USB. The unit can be used in either the horizontal or vertical alignment.

Capella Science
www.capellascience.com.au

Imaging software

WITec Suite software is now available for all WITec imaging systems. It was developed to acquire and process large data volumes of large-area, high-resolution measurements and 3D imaging while providing speed, performance and usability. Through the software architecture and graphical user interface, an integrated and consolidated functionality is available incorporating the various techniques and measurement modes, including Raman, to AFM, to SNOM, fluorescence and luminescence.

An intelligent computer resource management provides the capabilities for the generation and visualisation of large data sets. The high-speed data acquisition allows, for example, the measurement and recording of over 1300 Raman spectra in only one second. Data sets including several million image pixels, each containing the information of, eg, a complete Raman spectrum or an AFM-pulsed force mode-curve, can be generated, processed and imaged smoothly.



The software design provides clear and intuitive menu guidance and an individually adjustable user interface suitable for all experience levels and user requirements. The smart access options for all principle functions accelerate the workflow and smooth the first steps into the software and an accessible learning curve.

The suite includes Control FOUR, a powerful software tool for measurement control and data acquisition, and Project FOUR, a user-friendly data evaluation and processing software. The licence terms facilitate the installation of Project FOUR on an unlimited number of computers, permitting the user to process data and generate images wherever required.

Alphatech Systems
www.alphatech.co.nz

The pipette is one of the most commonly used handheld instruments in a research laboratory and the model of the pipette is chosen based on your needs for performance, ergonomics and quality. But it doesn't end there - you may have the most advanced pipette on the market but a poor quality tip means that the reproducibility of your results may be at risk.

A pipette tip is a pipette tip right?

Not even close

Don't be caught out; the fact is that quality pipette tips are critical to ensuring that the correct volume of liquid is aspirated and dispensed and that your samples are not contaminated in the process. Here are some quick hints to ensure that your pipette tips are a perfect match for your pipette of choice and do not compromise your lab work.

Not all tips are created equal

A pipette is only as good as the pipette tip attached. Following are some common terms and some basic considerations that will assist users to select the right tip for their tasks.

Quality moulding

- Evaluate your tips by giving them a visual inspection.
- Roll them on the table to see how straight they are.
- Does there appear to be any external inconsistencies or any irregularities in either cavity? If the tips are not moulded well, this will affect pipetting performance.

Plastics additives

Any metal additives found in pipette tips (yellow and blue tips in particular) can contaminate samples, potentially affecting the results of assays. High-quality pipette tips are marketed as being free of these additives.

Standard vs low-retention tips

It is crucial for all the liquid drawn into a pipette tip to leave the tip when it is dispensed. Although the polypropylene used in pipette tips is hydrophobic, some liquid is still held up in standard pipette tips, preventing accurate and repeatable results. Even with smooth surfaces (derived from quality moulding), standard tips tend to retain small amounts of liquid, especially sticky solutions of protein or DNA. A low-retention tip is designed to increase pipetting accuracy by eliminating tip retention and sample hold-up.

Standard vs filtered (barrier) tips

Filtered pipette tips are good for two purposes. First, they protect the pipette from aerosols which are created when liquids are aspirated into the pipette tip. Second, they protect the samples from aerosols in the pipette that were generated from prior pipetting operations.

Sterile vs DNA/RNase-free

Sterile tips undergo a sterilisation process (typically via radiation) to ensure that no living organisms are on them. Sterilisation, however, does not eliminate dead organisms or their biomolecules such as nucleic acids, ATP or endotoxins. For a number of biological assays the complete absence of these biomolecules is critical.

Researchers performing this type of sensitive testing should purchase tips that have been certified DNA-, RNase-, ATP- and endotoxin-free.

How to choose the right low retention tip

Not all low-retention tips are created equal. Some manufacturers add chemicals to their plastic mix or add a coating such as silicone to reduce liquid retention. These chemicals can contaminate your sample. If you need a low-retention tip, you should look for a tip that has its liquid repellent properties covalently bound to the plastic surface so that it cannot contaminate your samples.

Conduct a dye test

To compare the surface tension characteristics of selected tips, use a coloured solution such as a food dye, aspirate and dispense a set volume using the same pipette. Visually inspect the sample left behind in each tip.

Use a spectrophotometer

If the difference of sample retention between two tips cannot be determined by visual inspection, you can quantify it with a spectrophotometer. Simply aspirate and dispense a volume of food dye from your chosen tip then sequentially aspirate and rinse water into the same tip, dispensing the rinse solution into a cuvette. The bigger the absorbance, the worse the retention.

Using this method you can compare several tips to choose the best ones.

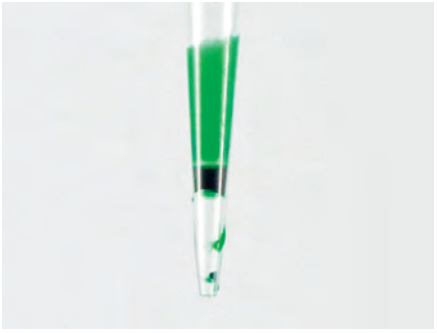
How to choose the right filtered tip

Not all filtered pipette tips are created equal. Some tip filters contain additives that block the flow of liquid and/or change colour if liquid is aspirated into them. They protect the pipette from the liquid but the sample is wasted and potentially contaminated.

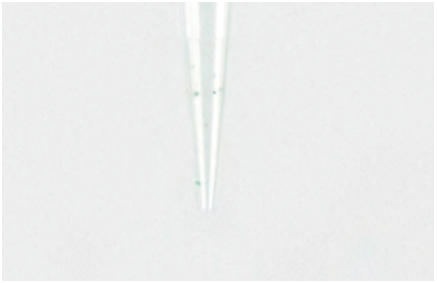
Choose the right material: Go with tips made of pure polypropylene and the filter of polyethylene without 'self-sealing' additives to avoid any interference with the sample and the results.

Ensure the right fit: Request a sample of filtered pipette tips to ensure the fit with the pipette of your choice. This is important as the filter occupies space inside the tip that may get in the way of the tip cone of your particular pipette.

Consider your volume requirements: The filter limits the volume of liquid that can be aspirated into the tip. If volume restriction is an issue, consider SafetySpace Filter Tips which leave more space between the sample and the filter than conventional filter tips. This allows pipetting any type of liquid or using any pipetting technique without the risk of the precious sample absorbing into the filter.



If your tip looks like this, then you are losing your samples.



Neptune S3 Low-Retention tips virtually eliminate sample hold-up.

What is perfect sealing?

In a perfect sealing scenario, the pipette tip is attached well enough to hold the pipette yet loosely enough to eject the tip effortlessly. The seal formed between the pipette and tip ensures leak-free pipetting; this is made possible by a flexible tip mouth.

Regardless of the type of features selected (low-retention, sterile, filter, etc), it's wise to do some qualification testing of the selected tip before using it for lab work.

What packaging options are available?

- Bulk in a bag - an economical solution for teaching labs. Tips are provided in a bulk bag and are racked manually into tip boxes, often by students. If required, these tips can be sterilised once racked.
- Racked tips - a convenient solution for research and diagnostics labs. Tips are packed and supplied racked.
- Environmentally Sustainable Pack (ESP) - designed to meet industry demands to minimise plastic waste by 90% and provide an environmentally friendly solution. ESP tips provide a low-cost alternative compared with racked product, while saving time not having to load bulk tips (reload 10 trays in as little as 90 seconds) and also halve the space needed to store inventory.

Pathtech Pty Ltd
www.pathtech.com.au

Funding dementia research

The research program for this year's Alzheimer's Australia Dementia Research Foundation (AADRF) will see $2.4 million shared between 25 of Australia's next generation of dementia researchers.

"There was very strong demand for these awards from the research sector this year, and our rigorous assessment process means that we are supporting the very best and brightest new and early-career dementia researchers," said the Foundation's chair, Scientia Professor Henry Brodaty.

Donna McCade from the Brain and Mind Research Institute at the University of Sydney was awarded a $50,000 project grant to assess whether a hormone-containing nasal spray will alleviate some of the symptoms associated with Alzheimer's disease.

McCade said that people with Alzheimer's disease often show impaired social cognition, including their ability to recognise emotions in others. This in turn affects social skills and relationships, and can have an impact on carers.

"Previous research suggests that intranasal administration of oxytocin can improve recognition of facial emotions in healthy adults, but this has never been tested in people with Alzheimer's disease," said McCade.

"With a treatment and cure for Alzheimer's disease and other forms of dementia still potentially years or even decades away, I am hopeful that my research will be able to help those living with the condition today and, just as importantly, alleviate the impact felt by carers when caring for a person with behavioural and psychological symptoms of dementia."

Alzheimer's Australia Dementia Research Foundation is the research arm of Alzheimer's Australia. The foundation receives support from the community, which is used to fund Australian early-career dementia researchers.

Ag science scholarship

Students who are keen about agricultural science and plan to start studying a university degree should set their eyes on the Horizon Scholarship.

An initiative of the Rural Industries R&D Corporation, in partnership with industry sponsors, the scholarship provides $5000 per year for the duration of a degree.

The scholarship also includes the opportunity for annual industry work placements, giving students first-hand experience of modern agricultural practices, access to professional development workshops and opportunities to network at a range of industry events.

To be eligible students must be entering their first year of university and studying a degree related to agriculture, such as agricultural science, rural science, livestock/animal science, veterinary science or agribusiness and plant science.

Students must also have started their tertiary studies no longer than two years after leaving high school.

Applications are now open and close on 30 January 2015.

For more information go to the RIRDC website.

Sponsors of the Horizon Scholarship are ANZ, Woolworths, Lallemand Animal Nutrition, the Australian Department of Agriculture, the Australian Egg Corporation, Australian Pork Limited, the Cotton Research and Development Corporation, the Grains Research and Development Corporation, Horticulture Australia Limited, Meat & Livestock Australia, Sugar Research Australia, McCaughey Memorial Institute, and RIRDC (Rice and Chicken Meat research programs).

ARC 2015 major grants announced

The Australian Research Council (ARC) Major Grants have been announced with $354 million distributed to 941 new research projects for funding commencing in 2015.

The $354 million will fund a broad range of research areas including school curriculums to improve our education system, 3D imaging and printing to deliver better health and industry outcomes, improving plant diversity to enhance crop yields, and preserving Indigenous heritage.

The funding allocation included:

- Discovery research - $250 million for 665 projects under the Discovery Projects scheme, with a success rate of 18%.
- Early-career researchers - $70.6 million for 200 projects under the Discovery Early Career Researcher Award scheme, with a success rate of 14.3%.
- Indigenous researchers - $4.4m for 10 projects under the Discovery Indigenous scheme, with a success rate of 31.3%.
- Research infrastructure - $29m for 66 projects under the Linkage Infrastructure, Equipment and Facilities scheme, with a success rate of 41.5%.

More information can be found on the ARC website.

Reproducible evaporation of environmental samples

The EZ-2 ENVI from Genevac is designed for gentle evaporation of volatile environmental samples, such as pesticides, and provides good recovery and reproducibility. The system is fully automated, can concentrate a number of samples at the same time and provides protection from cross-contamination and bumping.

To safeguard sample integrity during rapid and safe evaporation, Genevac has pioneered the development of a range of innovations including SampleGuard temperature control, the Dri-Pure anti-bumping system and SampleGenie technology. The design of SampleGenie enables the EZ-2 ENVI to productively concentrate environmental samples to less than 1 mL without losing any volatile analytes.

The smart sample evaporator saves time and delivers optimal performance and solvent recovery. Just load the samples, select maximum safe temperature for samples, select solvent type and hit start. Autostop, when dry or concentrated, means the product offers unattended operation.

Requiring no peripherals for operation, the compact unit fits neatly onto a laboratory bench or into a fume hood. All key components on the robust system are user-serviceable to ensure a low cost of ownership. The product also includes a suite of specialised stored methods to enhance productivity and reproducibility when preparing environmental samples for analysis.

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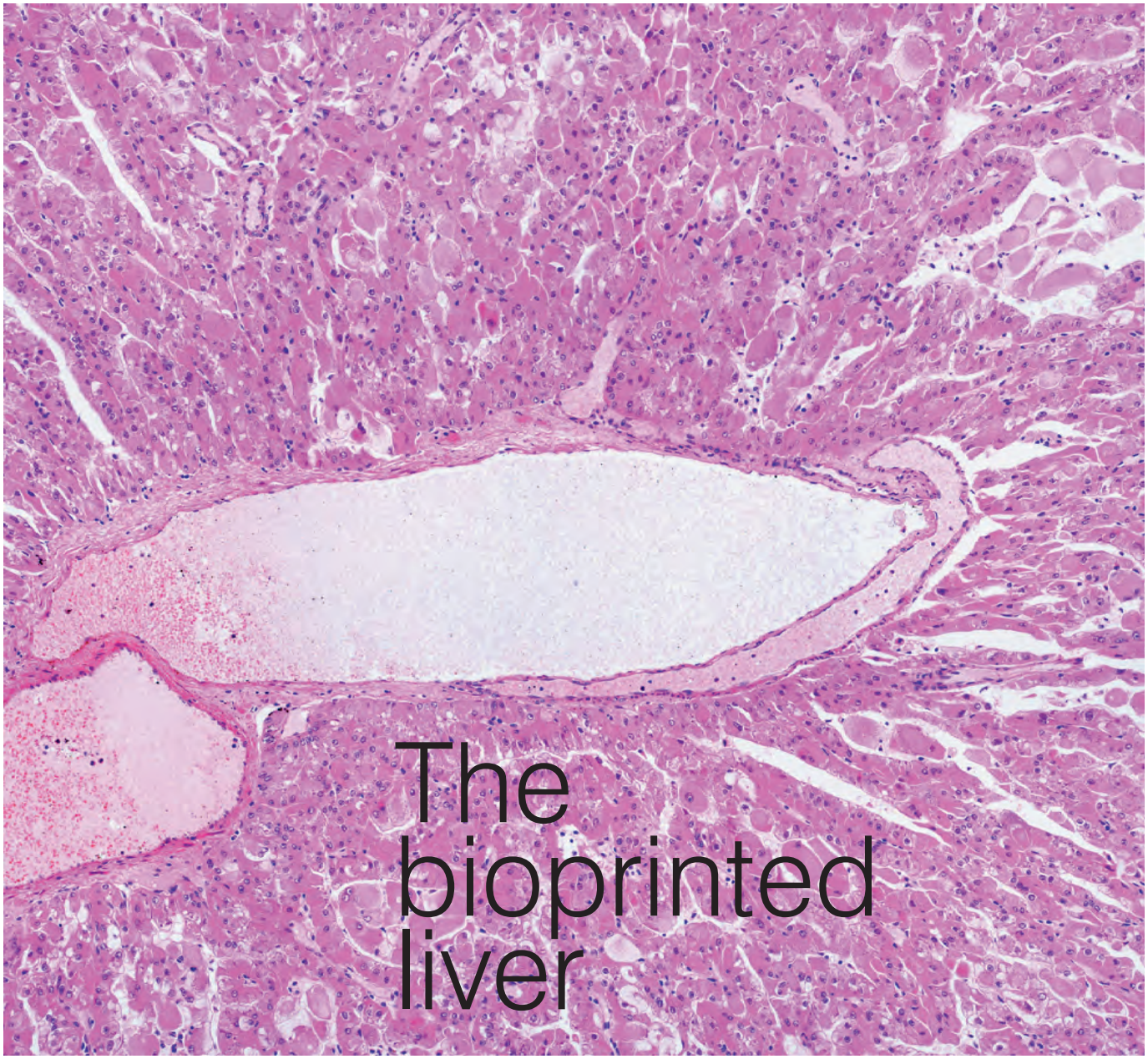


The bioprinted liver

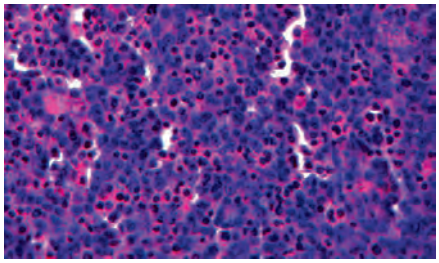
Bioprinted liver tissue containing both parenchymal and non-parenchymal cells in spatially controlled, user-defined geometries that reproduce compositional and architectural features of native tissue are making it possible to assess drug effects over timeframes much longer than those offered by 2D liver cell culture systems.

The liver is responsible for many things: filtering the blood, metabolising and transporting drugs, and producing a myriad of proteins that are critical to homeostasis (albumin, clotting factors, enzymes involved in protein metabolism). It is also central to the pathogenesis of several infectious diseases, including hepatitis, and it can also be seriously and irreversibly injured by chronic exposure to alcohol. Many genetic disorders are linked to reduction or absence of proteins that would normally be produced by the liver. No wonder that a lot of research centres on liver function and biochemistry.

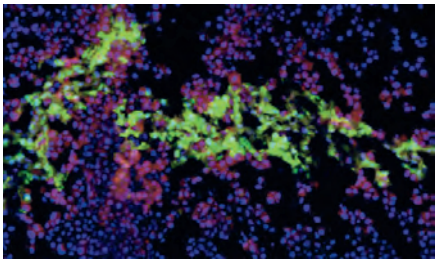
Most liver functions are dependent, in part, on architecture. Hepatocytes inside the body have a nearly unlimited capacity for replication. When as much as two-thirds of a whole healthy liver is surgically removed, the hepatocytes within the liver remnant undergo rapid and extensive proliferation to restore liver mass completely. Inside the body, hepatocytes are polarised along a border of endothelial cells, with formation of canaliculi along their apical surface and tight junctions between neighbouring cells.

However, once removed from the body, hepatocytes replicate poorly and rapidly lose critical liver-specific functions. Loss of polarisation - as occurs when hepatocytes are cultured in simple monolayers on standard tissue culture-treated plastic - leads to loss of function and an inability of the hepatocyte to maintain the intracellular architecture that enables absorption, transport and bile production.

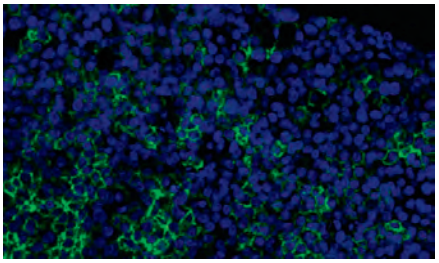
While liver cells, in particular the parenchymal hepatocytes, have been widely used in the laboratory to assess the potential toxicity or efficacy of drugs,



Cross-section of multicellular bioprinted human liver tissue, stained with hematoxylin & eosin (H&E).



Cross-section of bioprinted human liver tissue demonstrating compartmentalisation between the hepatocytes (shown as blue nuclei), endothelial cells (red) and hepatic stellate cells (green).



The image above shows formation of intercellular junctions between hepatocytes in bioprinted liver tissue, highlighted by E-Cadherin immunochemistry (green).

the loss of function has limited their usefulness. What is needed is a method whereby hepatocytes can be maintained in culture environments that support polarisation and three-dimensionality and so retain critical functions for longer periods outside the body.

> "... bioprinting ... enables fabrication and comparative testing ... so that winning combinations can be identified systematically based on histological and functional outcomes."

Bioprinted liver tissue model

Organovo's NovoGen Bioprinting platform has been used to generate bioprinted liver tissue prototypes that contain both parenchymal and non-parenchymal cells in spatially controlled, user-defined geometries that reproduce compositional and architectural features of native tissue.

One advantage of the automated bioprinting platform is that it enables fabrication and comparative testing of multiple compositions and geometries so that winning combinations can be identified systematically based on histological and functional outcomes.

Beginning with hepatocytes (the predominant parenchymal cells of the liver), designs were created based on shapes and cellular interfaces found in native liver tissue. Non-parenchymal cells, including endothelial cells and hepatic stellate cells, were positioned in defined locations relative to hepatocytes, creating a compartmentalised architecture that was established at the time of fabrication and substantially maintained over time in culture.

In addition to the cell type-specific compartmentalisation, two histomorphological features can be appreciated in these bioprinted liver tissues: 1. The development of microvascular networks within the tissue; and 2. the formation of tight intercellular junctions among the hepatocytes.

Importantly, these multicellular, 3D liver tissues possess critical attributes central to liver function, including production of liver-specific proteins such as albumin and transferrin, biosynthesis of cholesterol and inducible cytochrome P450 activities, including CYP1A2 and CYP3A4. Production of the liver-specific protein, albumin, was 5 to 9 times greater on a per-cell basis when compared to matched 2D controls. These functional data, combined with the unique histological features of the tissues, suggest they may be a compelling alternative to traditional 2D hepatocyte cultures for predictive studies, especially those involving longer-term tissue toxicity assessments or studies of disease development and progression where results need to be interpreted in the context of cell-cell interactions.

The overall goal of studies like these is to develop living, multicellular human tissues that can be maintained in the laboratory environment for extended periods of time and sampled serially for both functional and histological changes in response to injury, pathogens or treatments.

3D bioprinted human liver tissue now available

Using 3D bioprinting technology, Organovo Holdings has released its exVive3D Human Liver Tissue for preclinical drug discovery testing. This model is intended to provide human-specific data to aid in the prediction of liver tissue toxicity or ADME outcomes in later-stage preclinical drug discovery programs.

Organovo's exVive3D Liver Models are bioprinted, living 3D human liver tissues consisting of primary human hepatocytes, stellate and endothelial cell types, which are found in native human liver. The exVive3D Liver Models are created using Organovo's proprietary 3D bioprinting technology that builds functional living tissues containing precise and reproducible architecture. The tissues are functional and stable for at least 42 days, which enables assessment of drug effects over study durations well beyond those offered by industry-standard 2D liver cell culture systems.

Organovo has previously shown that exVive3D Liver Models produce important liver proteins including albumin, fibrinogen and transferrin, synthesise cholesterol and possess inducible cytochrome P450 enzymatic activities, including CYP 1A2 and CYP 3A4. The exVive 3D Liver has successfully differentiated between structurally related compounds with known toxic and non-toxic profiles in human beings and the model has also been employed successfully in the detection of metabolites at extended time points in vitro. Importantly, the configuration of the bioprinted liver tissues enables both biochemical and histologic data to be collected so that a customer can investigate compound responses at multiple levels.

The durability and functionality of the 3D liver product enable the assessment of the effects of low dose or repeated dosing regimens across a spectrum of biochemical, molecular and histologic end points. Initially, users will be able to access the technology through Organovo's contract research services program. All testing will be performed at Organovo's facility by the company's laboratory services tissue experts.

Organovo Holdings
www.organovo.com

Particle-size measurement accessories

The Mastersizer 3000 laser diffraction particle size analyser enables rapid particle size distributions for both wet and dry dispersions. Measuring a particle size range of 3.5 mm to 10 nm, it delivers high performance in a small footprint and enables operator-independent measurements. The product now has two accompanying accessories: the Hydro Sight, an imaging accessory; and the Hydro SV, a small-volume wet dispersion unit.

Hydro Sight provides real-time imaging of the liquid dispersion process in line with the user's laser diffraction particle size measurement.

Hydro SV is a wet dispersion unit requiring just 5.6-7 mL of sample. It is provided with a magnetic stirrer to ensure representative sampling and a wash-station accessory. The device is particularly useful to support early-stage product development to predict and control properties such as product stability, uniformity, flowability and appearance. It can also help with understanding the processability of a new material.

ATA Scientific Pty Ltd
www.atascientific.com.au

Cell imaging multimode reader

BioTek introduces the Cytation 5 Cell Imaging Multi-Mode Reader. The second-generation imaging reader includes added functionality to both the automated digital microscopy and conventional multimode microplate detection modes, enhancing phenotypic cellular information and well-based quantitative data.

The product's microscopy module provides cellular visualisation up to 60x magnification in fluorescence, brightfield, H&E and phase contrast modes.

The device also includes temperature control to 65°C, CO_2/O_2 control, shaking and Gen5 software, designed to make sample detection, image capture and analysis quick and effortless.

Millennium Science Pty Ltd
www.mscience.com.au

Continuous inkjet printer

The Linx CJ400LE printer is tailored specifically for coding and marking in laboratory environments. It brings the simplicity and flexibility of the Linx CJ400 continuous inkjet printer to a version adapted to a lab, where it is used to code onto Petri dishes.

Teamed with an extensive range of inks, including odourless, low-evaporation and non-MEK options, the product delivers clear codes onto a range of substrates. Easy to use, clean and unobtrusive, its compact design means it weighs only 13.5 kg complete with fluids, and its small footprint takes up little bench space.

The hermetically sealed printhead is designed for mess-free operation with minimal cleaning. Typically it will cope with up to 100 starts and stops without manual intervention, making it suitable for multiple short runs. Fluid refills are quick and easy without opening the printer.

The unit starts up quickly and its Easi-Change Service Module can be changed in minutes, allowing scheduled maintenance to be carried out without the need for a trained technician or service call. Other innovations deliver a reduction on cleaning costs, ink and solvent consumption.

The printer's easy-to-use colour touch screen means users don't need complicated manuals or training, reducing the risk of error. A low-noise cooling system assures unobtrusive reliability. Ethernet connectivity means the device can integrate with other equipment.

Matthews Intelligent Identification Pty Ltd
www.matthews.com.au

Storage system for LN_2 refrigerators

Statebourne Cryogenics has developed the Biorack racking system based on a 133 x 133 mm footprint to accommodate blood bags, cord blood bags, Falcon tubes, 96-well plates and IVF straws in a narrow-neck LN_2 refrigerator.

The Biorack range of LN_2 freezers holds up to 6000 x 2 mL cryovials in 100-place cryoboxes. The refrigerators have a neck diameter of 216 mm and a low loss rate (<1 L per day). They are suitable for mid-range users as they have a high storage capacity but a low consumption of LN_2 and samples can be stored in liquid or vapour phase. Traditionally, such vessels only store 2 or 5 mL tubes, so users with increasing numbers or types of samples would need to purchase a wide-necked LN_2 refrigerator.

The company can custom-build racks to suit other tubes and users can mix and match up to six different types in the same unit.

Capella Science
www.capellascience.com.au

Stereo microscopes

Nikon Metrology has released three stereomicroscopes: the SMZ1270, a stereo microscope with a large zoom ratio; the SMZ1270i, a version of SMZ1270 with intelligent features; and the SMZ800N, with enhanced optics and operability.

With their redesigned optics and advanced features, the stereo microscopes provide very good optical performance and enhanced operability, enabling researchers to carry out high-magnification, large-zoom-ratio and high-definition imaging with ease. The clarity of the images and improved ease of use will benefit researchers in a variety of fields, from medical to industrial.

Stereo microscopes have independent optical trains for the right and left eye paths, and thus naturally extend intrinsic stereoscopic viewing capability. In industrial applications, the instruments are used for research, development and quality control of products. They are required to provide advanced optical performance, such as high-magnification imaging and large fields of view, as well as ease of use.

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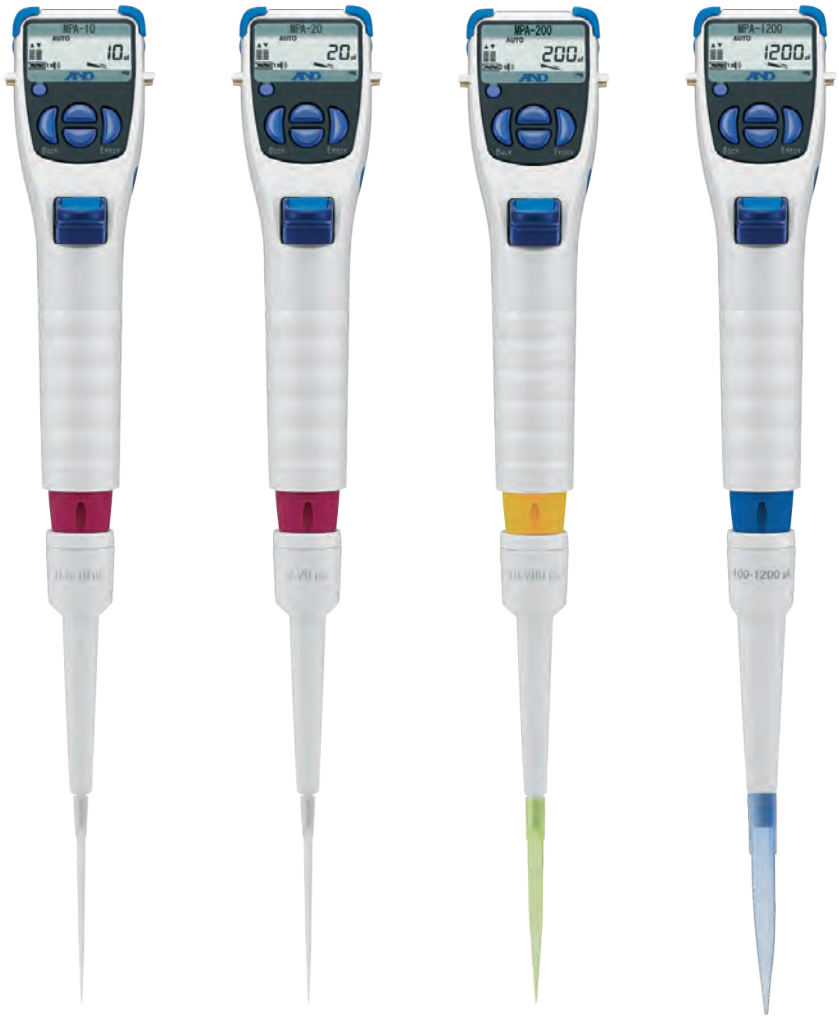

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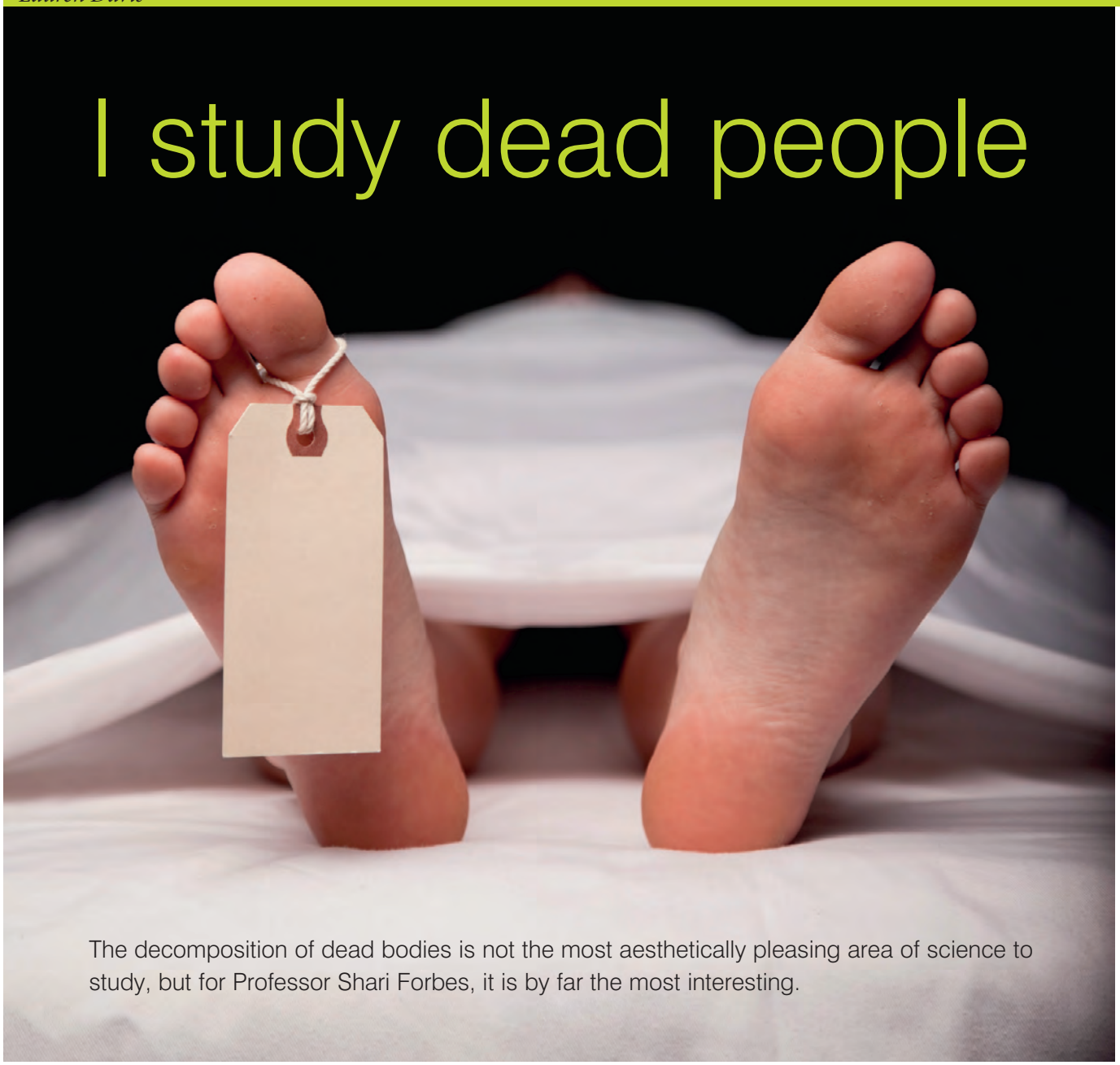
Lauren Davis

I study dead people



The decomposition of dead bodies is not the most aesthetically pleasing area of science to study, but for Professor Shari Forbes, it is by far the most interesting.

As a graduate of the first forensic science degree in Australia, at the University of Technology, Sydney (UTS), Professor Forbes is excited to be involved in a major step forward in her field: the first facility in the Southern Hemisphere to study decomposition using donated human cadavers.

After a stint at the University of Ontario Institute of Technology (UOIT) from 2005-2012, where she helped establish its forensic science program and two associated facilities, Professor Forbes returned to her alma mater as a professor and ARC Future Fellow in the Centre for Forensic Science. Through her work in taphonomy - the study of organic remains from the time of death to the time of discovery - she aims to identify an accurate biochemical signature for estimating time since death, in order to enhance the performance of sniffer dogs tasked with locating human remains.

So far, due to approval issues, Professor Forbes has been restricted to working with porcine cadavers - an analogue for humans with a similar decomposition process. In recent studies, the carcasses were placed in and under the ground in an outdoor laboratory, while their degree of composition, odour and environmental variables were measured over several weeks. Published in the journal *PLOS One*, the work enabled Professor Forbes to identify "hundreds of volatile organic compounds which comprise the odour of decomposition", she said.

But ongoing discrepancies continue to plague various researchers' studies in this area, which may be a result of unknown differences between pig and human decomposition and/or environmental variables. With the establishment of the new taphonomy facility - and the UTS body donation program, which allows the public to leave their body to science - this will hopefully change.

"The opportunity to conduct this research using human remains will allow us to determine a complete and accurate decomposition odour profile for our specific environment," said Professor Forbes. "This will assist us to identify the key compounds to which cadaver dogs alert, and we can use this information to improve their training and thus improve their success when deployed to search for victim remains - such as missing persons, victims of homicide and victims of mass disasters."

Cadaver dog training methods vary throughout the world. Professor Forbes noted that in the UK, some of the animals are trained using pig remains, whereas Australian dogs are exposed to human blood, decomposition fluid, grave soil, teeth or bones. By allowing researchers to compare the scents of these training aids and porcine remains with human cadavers, the facility will be able to determine

just how accurately they serve as analogues - and pass on their data to those who don't have such access to human remains.

Odour profiling will be just one of many lines of research taking place at the facility, which is a multidisciplinary collaboration between UTS, the University of Wollongong (UOW), the Australian Nuclear Science and Technology Organisation, the Victorian Institute of Forensic Medicine, The University of Sydney, University of Canberra, The Australian National University and The University of New England, as well as the Australian, Victorian and NSW police forces.

"The facility will be open to a broad range of disciplines who can benefit from the research being conducted," said Professor Forbes. "This includes forensic chemists, biologists, anthropologists, odontologists, toxicologists, archaeologists and palaeontologists - just to name a few!"

For example, researchers from UOW's Centre of Archaeological Science plan to use the facility to study bone decomposition and the geological and chemical changes in burial sites over time, which will assist with interpreting archaeological and paleontological sites both in Australia and overseas. Professor Forbes continued, "Our intent is to benefit as many disciplines as possible so that we can advance these sciences in Australia and internationally."

These benefits have been recognised by the Australian Research Council (ARC), which has awarded the facility with a $430,000 Linkage Infrastructure, Equipment and Facilities (LIEF) grant. This grant, combined with Professor Forbes' own experience from her work at UOIT, will enable the building to be established on land owned by UTS on the outskirts of Sydney, where it is expected to be completed by around mid-2015.

At a personal level, the facility will provide Professor Forbes with a new opportunity to conduct research with real-world impacts; indeed, the reason she studied forensic science in the first place was because "the application was immediately clear to me". And with the facility's research expected to benefit not only the police and other researchers, but also the families of those whose remains might be discovered, it is obviously clear to the community as well.

"I am always amazed by how interested people are in my research, particularly given that it is not exactly a topic that most people really discuss," Professor Forbes admitted. "So although the facility will not be open to the general public, I have learnt the importance of talking about my research to the community so that they understand the impact and can engage in discussion around it. My intent is to continue doing this with the new facility."

Science Fiction Becomes Science Fact

The work of scientists has long been fuelled by the imagination of writers: lasers, robots, rocket ships and atomic power were all described in fiction long before they became a reality. Today, the frontiers of science continue to be inspired by ideas that were first explored in science fiction.

In this speaker series, attendees will hear from Australians whose work is so incredible you'll be surprised it actually exists. From artificial intelligence to quantum computing, invisibility to mind control, you won't believe how much science fiction is about to become science fact.

The seminar series, convened by Professor Bryan Gaensler, chaired by Dr Rod Lamberts of the Australian National Centre for the Public Awareness of Science and organised by the Australian Academy of Science, will run from 3 February to 1 December 2015 at the Shine Dome in the ACT.

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www.lorneproteins.org

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www.lornecancer.org

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www.lornegenome.org

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www.esaclinicalweekend.org.au

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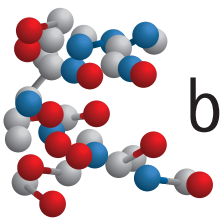

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