



REGIONAL GROWTH



SHRINKING SHORELINES



HOPE FOR CF PATIENTS



MECHANICAL MIMIC



WINTER -PROOFING BARLEY



Research to Reality

2011 Edition 9



If anyone has doubts about the practical application of university research, then perhaps this edition will reassure them. Showcased here are eight examples of UTAS-driven research that promises to make a real difference to people's lives and to Australia's future economic prosperity. This is not research for research's sake.

Associate Professor Meixue Zhou, who is featured on the cover, and his colleagues at the Tasmanian Institute of Agricultural Research are developing a new variety of barley that will be more tolerant to waterlogging. Barley is Australia's second biggest cereal crop, after wheat, and Professor Zhou's work could ensure that Australia continues to dominate the global export market.

Similarly, David Maynard and his Australian Maritime College team are poised to make a significant impact on the future of fishing, with the development of a technique that not only reduces bycatch in an industry with a high wastage rate but actually increases the haul of prawns.

Professor Paddy Nixon
Deputy Vice-Chancellor (Research)

A doughnut-shaped 50m pool could one day allow people who live thousands of kilometres from the ocean to surf in comfort, indoors. Through a partnership between the Australian Maritime College, a company named Webber Wave Pools and the Delft University of Technology in the Netherlands, researchers have been working on creating artificial waves suitable for surfing.

The research team is led by the AMC's Dr Jonathan Binns, and a number of successful small-scale tests have already taken place.

Team member Professor Martin Renilson said a rotating 'wave dozer' could generate waves, which in theory would allow surfers to keep circling the pool for as long as they wanted.

"Surfers don't just want a big wave, they are actually pretty fussy," Prof Renilson said. "They want waves to behave in a particular manner and to move at a certain speed. Getting exactly the right sort of wave is extremely complex and very difficult to predict."

Prof Renilson said the research work had delved into new areas, particularly as much former study in hydrodynamics had focused on reducing the size of waves, not increasing them.

"At AMC we have done a lot of work since the mid 1980s to reduce the size of waves that vessels make, because waves take energy," Prof Renilson said.

"So we know a lot about generating waves and we know about trying to reduce them, but this goes into some new territory."

The shape of the pool allows for a circular island in the centre, which Prof Renilson said could contain a beach, surf shops, cafes or even restaurants. Surfers could simply step onto the beach to visit the island and then catch the next wave around the pool.

"In principle you could just keep surfing forever, but in practice I think people would start to get tired," Prof Renilson said.

"You could also have somebody moving on a trolley around the pool to instruct the surfer. By shifting the angle of the wave dozer, and the speed, you can also change the size of the waves. So the one wave pool could be making fairly small waves in the morning for the beginners, and then in the afternoon you could crank it up and have expert competitions with bigger waves."


While much work remained to be done studying variables such as water depth, bottom topography, speed and wave patterns, Prof Renilson said there had been some initial commercial interest in the project.

"While it would be a fairly major capital expense it would be a lot cheaper than, say, a golf club," he said. "You can imagine people in parts of the world where surfing is not possible using this quite a lot."

The amount of energy it takes to drive the dozer around is fairly small compared with the standard wave pool that has a great big wave-maker at one end, which only allows for a short surf and uses a lot more power."



Surf's up at Newnham



Main image: From left, Greg Webber, director of industry partner Webber Wave Pools, project manager and PhD candidate Steven Schmied and Sanne Van Essen, a masters student from Delft University of Technology in the Netherlands), are making waves at the AMC. Inset: Steven Schmied adjusts the rotating 'wave dozer'.

This project was supported by almost \$285,000 in funding over three years through an ARC Linkage grant.



The quest for watertight genes

UTAS researchers are looking to produce a new type of barley that can withstand the ravages of the Tasmanian winter.

Researchers at the Tasmanian Institute of Agricultural Research's Mt Pleasant Laboratory, led by Associate Professor Meixue Zhou (pictured), have been working to identify the genes responsible for tolerance to waterlogging in barley.

Barley is Australia's second biggest cereal crop, after wheat, with annual production averaging 6.6 million tonnes.

"It's a very important industry," Assoc Prof Zhou said.

Australia produces about 32 per cent of the world's malting barley and 20 per cent of the feed barley. More than a half of China's imported malting barley supply comes from Australia.

Assoc Prof Zhou has spent more than 10 years looking at stressors on the crop such as frost, drought, salinity and acid soil conditions. But a particular interest is waterlogging, which occurs in high-rainfall areas such as Tasmania and much of southern Australia.

AUSTRALIA PRODUCES ABOUT 32% OF THE WORLD'S MALTING BARLEY AND 20% OF THE FEED BARLEY.

High rainfall during winter can significantly damage crops, so farmers in northern Tasmania tend to hold off sowing barley until spring, when conditions are drier.

The usual autumn sowing seasons are May/June through to around Christmas and the usual spring sowing seasons are September/October to February/March.

"At the moment a lot of high-rainfall areas sow barley in spring to avoid waterlogging, but in most of the barley production areas, spring sowing is not practical because of the dry and hot summers," Assoc Prof Zhou said.

The identification of the tolerance gene is difficult but crucial for breeders to select tolerant varieties. Through a variety of research techniques, including simulated field trials, Assoc Prof Zhou has set up a reliable

screening system and identified some chromosome regions (quantitative trait loci) that are closely linked with waterlogging tolerance. He said the next step was to fine-map these regions and look for perfect markers. These markers can be easily adopted by other breeders to select waterlogging-tolerant varieties without field trials.

"We used to do work on breeding but now we are focused on pre-breeding work, providing other breeding programs with improved germplasm and molecular markers linked with different stress tolerances," he said.

"We will also try to clone and sequence the genes responsible for the tolerance. When the gene cloning and sequencing are completed it will have a significant impact on the market. However, that is still a few years off.

"It's a very long process," Assoc Prof Zhou said.

This project is funded by the Grain Research and Development Corporation as part of an Australia-China collaborative project.

Carrying the weight of the world

For years we've been aware that childhood obesity is linked to a long list of health problems, including cardiovascular disease and diabetes. Yet very little has been known about the possible long-term risks to mental health – until now.

A team of epidemiologists from the Menzies Research Institute Tasmania set out to examine the associations between childhood obesity and mental disorders in young adults (such as mood, anxiety and substance). They found a direct link, with overweight boys and girls having an increased risk of clinical mood disorder in adulthood.

But the most surprising finding of the ongoing study concerned overweight girls who don't shed the extra kilos as they grow into adulthood. These women double their risk of depression.

"There have been two other studies in the world showing that childhood weight might be associated with depression in adults," the lead researcher for the paper, Dr Kristy Sanderson, said. "We were the first to show the importance of sex differences in terms of an adult's eventual weight and risk of clinical depression."

WHEN WE DID THE INITIAL STUDY IN 1985, ONLY ABOUT 9% OF BOYS AND GIRLS WERE OVERWEIGHT OR OBESE. TODAY, THAT NUMBER IS CLOSER TO 25%.

More than 2,000 male and female participants from a 1985 national Australian school survey (then aged 7-15 years) were re-interviewed by Menzies, led by Professor Alison Venn, in 2004-06. Body mass index (BMI) was calculated from each person's weight and height in childhood and adulthood, and then compared with a measure of their mental health, as diagnosed by the World Health Organisation's Composite International Diagnostic Interview.

The next wave of this ongoing research will involve interviews with the study's participants, who are now in a time of transition in their lives: having

children, getting married/divorced and experiencing changes in their employment. These interviews will be completed in 2011.

"The long-term goal of this study is to look at what factors in childhood predict risks for cardiovascular and related diseases later in life," Dr Sanderson said. "But the depression angle is particularly important as it may itself increase risk for these diseases. When we did the initial study in 1985, only about 9 per cent of boys and girls were overweight or obese. Today, that number is closer to 25 per cent.

"But childhood overweight and obesity can be addressed. This study is helping us understand how to intervene earlier in people's lives, by looking at what predicts healthy lifestyle changes as children become adults."

This study is supported by a total of \$2.9 million in grants from the National Health and Medical Research Council, the Heart Foundation, Tasmanian Community Fund and Veolia. Dr Sanderson is supported by an Australian Research Council Future Fellowship.



Direct link between childhood ... Menzies' Dr Kristy Sanderson, lead researcher in a study examining the associations between childhood obesity and mental disorders in young adults.

The Tasmanian Social Enterprise Study was funded by a \$20,000 State Government grant.

Great enterprise at a grassroots level

Social enterprises are the backbone of many communities across Tasmania. The sector's impact, importance and relevance to local and regional communities crosses economic, social, environmental and cultural domains.

However, just exactly what Tasmanian social enterprises are and what they do has, until now, been largely unknown and documented.

In partnership with the Tasmanian Government, the UTAS Institute for Regional Development (IRD) undertook the Tasmanian Social Enterprise Study in early 2011. For the first time the state's social enterprise sector was profiled, providing data about what social enterprises look like, what they do and where they work.

One of the crucial findings was what they require in order to grow and prosper. Social enterprises are businesses or organisations that provide a public or community benefit by conducting regular trading activity. Some of the proceeds from trade are reinvested into the community.

They can range from festivals to farmers markets; from cooperatives to small operations. They straddle the boundaries between business and the not-for-profit sector, leveraging entrepreneurial activities to fulfil a social mission. Along with government and the private sector, social enterprises also help to underpin and support a vibrant regional economy.

IRD senior researcher Dr Robyn Eversole and industry-based IRD research associate Kylie Eastley worked with government project partners and an industry-based advisory group to design and conduct the study, in which 111 social enterprises participated.

The study involved an online survey, social enterprise case studies, an online blog and the development of a preliminary database. "Social enterprises are active in the Tasmanian community, providing benefits to a wide range of community members and tackling significant social issues in creative ways," Dr Eversole said.

Main: Dr Robyn Eversole (sitting) with research associate Kylie Eastley.

Inset: (From left) Associate Professor Jo Barraket (QUT), Penelope Dodd (Produce to the People enterprise), Dr Robyn Eversole (IRD, UTAS) and Dr Belinda Luke (QUT) at a social enterprise forum organised by the University's Institute for Regional Development.



Bloomin' marvellous

One of the North-West Coast's social enterprises, the Tulip Festival, continues to bring a smile to faces young and old. Now into its 21st year, the Wynyard event has evolved from a small gathering to a huge community event hosting food, entertainment and attractions, which drew a record crowd of 15,000 in 2010.

The annual festival is held to coincide with the flowering at the Van Diemen Quality Bulb Tulip Farm at Table Cape in October. It celebrates the township's unique relationship with tulips, marking the celebration with a line-up of local art, music, performance and food.

The operation of the festival has changed over the years – moving from an incorporated body and volunteer committee to a council-appointed project officer.

The sheer dedication, pride and work put in by volunteers and community groups have largely ensured its success.

The festival has two components: the event itself and the Foreshore Market. The market is held every second Sunday and aims to raise funds for the festival.

The market not only provides an avenue of commerce for small traders across the craft, food, clothing and textile industries, but is an important destination for townspeople and visitors.

OUR WORK IS ABOUT ASKING AND ANSWERING QUESTIONS OF SIGNIFICANCE FOR REGIONAL DEVELOPMENT. BUT WE DON'T DO THIS ALONE.

"They work across nearly all sectors of the economy and trade in local, regional, national and international markets."

Dr Eversole said the key to the project's success was the collaborative approach taken. "The way we carry out research in the IRD is distinctive," she said.

"Our work is about asking and answering questions of significance for regional development. But we don't do this alone. We work with partners to help them scope and carry out research on issues that matter to them. To do this we use a methodology called Knowledge Partnering.

"By working with government, industry and the University to ask and answer research questions, we have gained a good first set of data on social enterprises in Tasmania.

"At the same time the process has stimulated new research questions, collaborations and creative engagements."

One such collaboration is a development of an ARC Linkage project with Associate Professor Jo Barraket from the Australian Centre for Philanthropy and Nonprofit Studies and Professor Katherine Gibson from the University of Western Sydney.

Above: Straddling the boundaries between business and the not-for-profit sector ... the Burnie Farmers' Market.



Rising sea levels to wash away a sense of identity

BETWEEN 1950 AND 2006 THE SALT-MARSH SHORELINES ERODED, ON AVERAGE, BY 22 CENTIMETRES PER YEAR.

UTAS researchers have analysed Tasmania's coastline in an effort to understand its value to local communities and find ways that they can respond to rising sea levels.

Dr Richard Mount of the School of Geography and Environmental Studies' Blue Wren Group has been mapping the implications of sea-level rise around Australia. In Tasmania the group has focused on the Circular Head region in the north-west, primarily Duck Bay, Boulanger Bay and Robbins Passage.

The group has developed coastal flood maps and a range of other geographical analyses, such as wind fetch mapping and shoreline erosion mapping. These allow researchers to see which shores are more likely to erode and to predict where water will flow onto the land as the sea level rises.

"These tools could be used by councils to make decisions – and by ordinary people too," Dr Mount said.

The study also carefully documented the evidence of sea-level change in the area.

"Sea-level rise is happening," he said. "The overall impact at the moment isn't large but

the rate of rise is accelerating, so the impact will only increase in the foreseeable future."

For example, between 1950 and 2006 the salt-marsh shorelines eroded, on average, by 22 centimetres per year.

As the sea level continues to rise, there will be social and economic implications for the region as a report by the team illustrates.

Credible experts, including those from the CSIRO, are recommending that planners allow for a 1.1 metre to 1.2 rise in sea level as the safety margin. If this happens, Dr Mount said, approximately 25-35 square kilometres of low-lying land in north-west Tasmania will be submerged, including agricultural land.

Sea-level rise also has the potential to affect aquaculture, trawler fisheries and recreational fishing.

"These activities are part of what it means to be from this area, so it's a sense of identity that could be lost," he said.

Fellow researcher Dr Jan Tilden said the amount of damage caused would depend on the way land owners and councils now start to manage the land. Building sea walls is not necessarily the answer.

She said coastal vegetation such as seagrasses and salt marshes could assist in preventing erosion. Over hundreds of thousands of years they have adapted to the sea level rising and falling, so they are able to "hold their own" against sea-level rise, while levees fail relatively easily.

"The habitats are extremely tough, they've done it before, they're perfectly evolved to deal with it," she said.

"We know these habitats will move landwards and upwards with sea-level rise and continue to resist erosion; all they need is the 'room to move'."

The seagrasses and salt marshes are not only useful in softening the impact of the sea and preventing erosion, they're also good at sequestering carbon.

The research team also includes Vishnu Prahald, Chris Sharples, Brigid Morrison, Dr Michael Lacey, Dr Joanna Ellison, Michael Helman and Jenny Newton, all from the School of Geography and Environmental Studies.



Main image: Mapping the implications of sea-level rise ... Dr Richard Mount on Nutgrove Beach in Sandy Bay.

Inset: (Right), the view from a helicopter of the western end of Robbins Passage in north-west Tasmania, a focus of the Blue Wren Group's research; (far right), Roches Beach near Lauderdale after a weekend of wild weather.



This project has been funded through a combination of the Natural Heritage Trust Extension and Cradle Coast NRM (\$93,000) and by a UTAS Community Engagement Grant of \$7,920.



Less bycatch a good net result

For each kilogram of trawled prawns you see in a market or restaurant, between three and 20 kilograms of sea life have died in bycatch. Researchers at the Australian Maritime College (AMC) have discovered a technique that not only reduces this wastage, but increases the haul of prawns.

According to National Centre of Marine Conservation & Resource Sustainability researcher David Maynard (pictured), commercial fishers caught 144 million tonnes of fish or seafood globally each year, but this was associated with 7.3 million tonnes of discards. These discards are fish that are unwanted, poor quality or too small.

“In some fisheries, bycatch issues are enough to question their sustainability,” he said.

Tropical prawn trawl fishing alone is responsible for more than a quarter of all discards. Generally the Australian prawn trawl fisheries don't fare too badly and are working with researchers to progressively reduce bycatch.

Over the past 15 years a variety of bycatch reduction devices have been developed. Typically they are some type of hole in the back of the net that allows some fish to escape.

“But some prawns get out so fishers dislike them,” Mr Maynard said. “A 5 per cent loss in prawn catch is a 5 per cent loss in fisher income, and nobody would appreciate a pay cut like that.”

The AMC bycatch research team is looking at the problem differently. Team Bycatch has found a way of exploiting a fish's response to light to

reduce bycatch. By placing lights at the leading edge of the trawl, they are able to reduce the amount of fish netted.

“It's like having big headlights on your car's bumper bar which cause rabbits to run off the road,” he said.

Prawn trawling is done at night and while prawns are attracted to lights, most fish are deterred.

Team Bycatch has conducted trials in three different commercial fisheries. In two of the trials bycatch was reduced by 30 and 20 per cent and prawn catch increased by 30 and 5.5 per cent, respectively.

If prawn catch rates can be increased, it means fishers will be able to catch the same amount of prawns in less time, meaning less sea time, less labour costs, less expenditure of fossil fuels and less of a carbon footprint.

“The good news part is not only can we reduce bycatch, we can make industry more efficient,” Mr Maynard said. “It's a win-win for industry and the environment.”

He said there was still a lot of work to be done on understanding fish behaviour in certain environments and creating a lighting system that is robust enough to last on a fishing boat, but eventually industry will be able to use this technology.

AMC's Team Bycatch includes marine biologist and ecologist Dr Troy Gaston and naval architects Associate Professor Giles Thomas and Rowan Frost.

This project has received \$88,000 in funding through the Natural Heritage Trust with assistance from the Australian Fisheries Management Authority.

Robotic arm gets a helping hand

A masters project in the UTAS School of Engineering is aiming to help prosthetic arms to move like real ones. Caillin Eastwood-Sutherland's project (pictured) has developed a way of integrating biological motions into a robotic arm.

"The idea is to work towards a prosthetic arm that can mimic biological motions. So it can pick up a drink and look like you're actually picking up a drink in a smooth, functional way. With a conventional prosthesis, it may be necessary to move parts of the arm manually to pick something up."

The project is connected to the work of engineer, machinist and amputee Mark Lesek, who is developing a functional prosthetic arm that can cope with machine work.

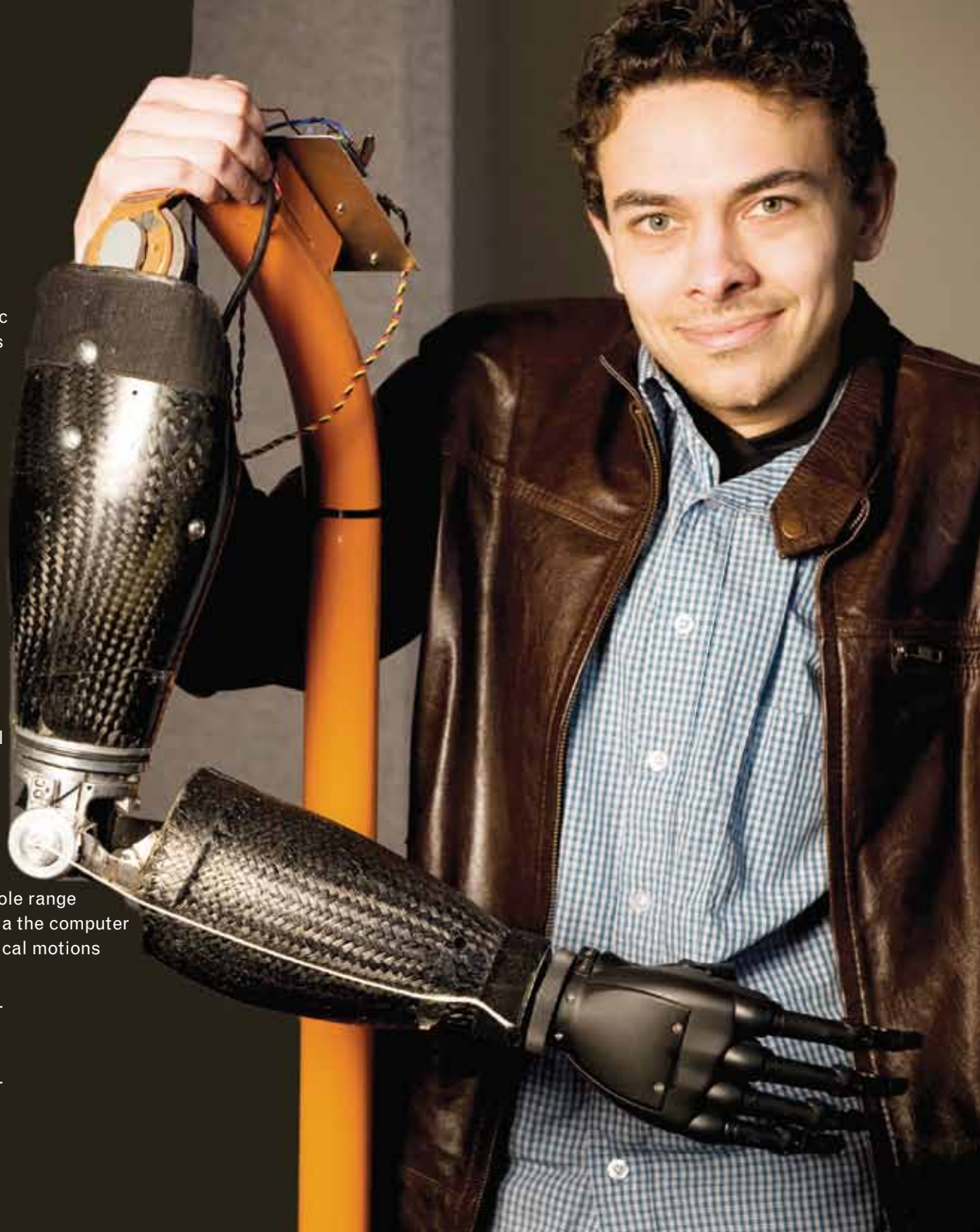
Caillin developed a stereo vision unit, comprising a tripod, camera and mirrors, to allow a 3D capture of movement. The subject straps infra-red markers onto their wrist, elbow and shoulder, so as they move their arm in front of the camera unit, the movements are copied into a computer by motion capture software developed by Caillin.

"The way it actually captures the movement of the arm is by tracking the infra-red markers on the arm. This can then be played back onto the model mechanical arm, so it mimics those movements performed in front of the camera unit."

Caillin said the ultimate goal of his project would be for people with a prosthetic arm to have a robotic prosthesis that can cope with a wide variety of functions and movements, which would be programmed into the arm itself.

"With this system, they would not have to manually program their prosthetic arm – that could be quite a long and frustrating process for them. If they needed a whole range of movements, then all of those movements would be programmed into the arm via the computer system. Then the arm could have many different user-selectable, realistic biological motions stored in it for the wearer's use."

THE IDEA IS TO WORK TOWARDS A PROSTHETIC ARM THAT CAN MIMIC BIOLOGICAL MOTIONS.



Breakthrough in battle against bacteria

Studies at the Menzies Research Institute are looking to make life more comfortable and longer for cystic fibrosis sufferers.

Cystic fibrosis is an inherited disease that causes thick mucus to develop on the lungs and digestive tract. Most patients have a reduced immune system and do not live past their 30s.

Associate Professor Margaret Cooley, co-leader Dr Louise Roddam and their team drawn from Menzies and the School of Medicine are researching a vaccine to make treatment more effective.

Previous Menzies research has found the presence of a type of bacterium, *Pseudomonas aeruginosa*, in the lungs of CF patients. It is an opportunistic infection, which means healthy people can fight it off often without knowing they even have it, but it has serious effects on people with reduced immune systems such as CF, burns and autoimmune patients.

Once infected, the bacteria form a slime layer, called biofilm, on the lungs, which is particularly difficult for antibiotics to break through. Assoc Prof Cooley's research is looking at preventing a small molecule within the bacteria from creating the biofilm.

HEALTHY PEOPLE CAN FIGHT IT OFF OFTEN WITHOUT KNOWING THEY EVEN HAVE IT, BUT IT HAS SERIOUS EFFECTS ON PEOPLE WITH REDUCED IMMUNE SYSTEMS.

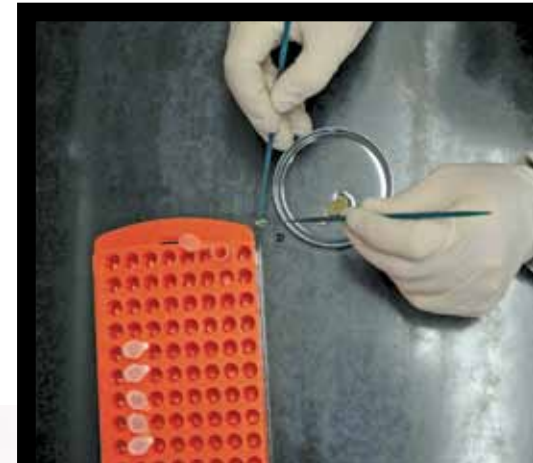
"The perfect opportunity is if we can stop the infection, but if we can stop the biofilm from forming, we can treat it with antibiotics," she said. The research is in its early stage but testing with laboratory models has shown promising preliminary results.

Other research into the disease at Menzies has looked at ways of boosting the immune system of CF patients so that they are more able to fight infection. She said cure was still a long way off but these techniques would make life better and they had already increased the average life span of CF patients by 20 years.

"It's all from better treatment of these symptoms and side effects," she said. "Realistically, for the foreseeable future, we've got to work out ways of making life better for people with CF."

The research team also includes Dr David Reid, Dr Phoebe Griffin, Dr Sam Beggs, Roger Latham, Hayley Dwyer and PhD students Fouziah Alqurni and Naseem Ali.

CF research at Menzies is funded via NHMRC project grants totalling \$900,000; Royal Hobart Hospital Research Foundation grants totalling \$33,000; the Australian Cystic Fibrosis Research Trust, \$96,400; and the Rebecca Cooper Foundation, \$18,500.



Main image: Associate Professor Margaret Cooley and the team ... from left, Roger Latham, Fouziah Alqurni, Naseem Ali, Assoc Prof Cooley, Dr Louise Roddam and Dr Phoebe Griffin. Not present are Dr David Reid and Dr Sean Beggs.

Inset: (Above), PhD candidate Naseem Ali and Assoc Prof Margaret Cooley studying a blood sample from the lungs of a cystic fibrosis sufferer; (top), Roger Latham with samples of sputum (a phlegm-like substance CF sufferers cough up).

OUR GRADUATES HAVE WHAT IT TAKES.

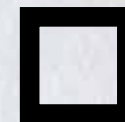
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