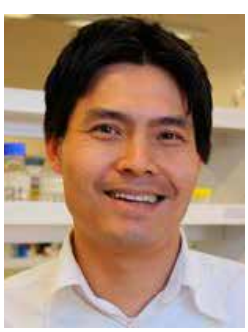
Serendipitous blood test for mouth cancer

by Melinda Ham

MORE THAN 300,000 PEOPLE DEVELOP ORAL CANCER GLOBALLY EACH YEAR, BUT UNTIL NOW THERE WAS NO TEST TO DETECT THIS DISEASE UNTIL PEOPLE WERE IN THE FINAL, AND OFTEN INCURABLE, STAGES.



Dr Nham Tran

Samantha Khoury

This is about to change. University of Technology (UTS) researcher Dr Nham Tran and PhD candidate Samantha Khoury have developed a world-first blood test that quickly and cheaply identifies oral cancer. The test will hopefully be available for worldwide use in less than two years and is anticipated to save many lives.

"Our test fills a void," Tran says. "Although there was a global race to develop blood tests for other cancers, until now for oral cancer, you could only have a biopsy of a suspected tumour. By then your prognosis was usually not good, with only about 40 per cent survival."

For Khoury, developing the test has been a personal journey after her grandfather died from Non-Hodgkin lymphoma in 2010, the same year she was scouting for an Honours project.

"I remember watching my grandfather slowly slip away, my whole family was standing around his hospital bed overcome with grief and had no way to assist him. I decided that I didn't want other people to go through that," Khoury says. "I was really determined to pursue preventive cancer research and finding Nham's project was serendipity."

Tran had sowed the seeds for the research eight years ago, when he was at the Royal Prince Alfred (RPA) Hospital working on human papillomavirus in oral cancers. Curiosity led him to hypothesise whether tiny molecules known as small ribonucleic acids (small RNAs) could be used as biomarkers for the early detection of oral cancer.

When Khoury joined his lab, she did a small pilot study for her Honours project that confirmed Tran's hunch; together they had discovered a set of six biomarkers that indicate a person has oral cancer.

With this concept, Khoury won the UTS final of UniQuest Trailblazer in 2012 – a competition from the University of Queensland that awards innovative early-stage research which has potential to benefit the community and be commercialised.

"It was this and a series of milestone moments for us which really set us in motion," Khoury says. Throughout her PhD, Khoury then tested blood from a further 400 patients collected from the RPA Hospital by head and neck surgeons.

Currently Khoury and Tran are filing a patent for their test which they have tentatively named miRacles, which costs significantly

Photo: Thinkstock

There is some resistance from multinational drug companies about preventive medicine

less to run than a biopsy. Using miRacles, a pathologist just needs serum taken in any routine blood test, and can get results back to the patient within 48 hours.

"Our hope is that the government takes it on as part of a national screening program, that a GP does routinely for all patients of a certain age," Khoury says. "Our core belief is that every individual has the right to access tools which make them aware of their health, allowing them to then act on that information."

In Australia and other Western countries, 70 per cent of oral cancer cases are men over the age of 60 years old who were heavy drinkers and smokers. Meanwhile in India, where 40,000 new cases are diagnosed each year, people in their 20s are displaying the cancer's symptoms because of the widespread practice of beetle nut chewing.

Khoury and Tran are actively exploring avenues to commercialise MiRacles. They have been part of the Stanford University's SPARK program which facilitates unique partnerships between universities and industry, advancing research discoveries "from the bench to the bedside". They have also enjoyed ongoing mentoring from ATP Innovations, Australia's largest start-up incubator and are seeking funding to drive this forward.

At the same time, the team has partnered with the Vellore Christian Medical College Foundation in India and the Baylor College of Medicine in Texas where larger cohorts of patients will be tested.

Tran is also exploring the possibility of using the test to detect other cancers, such as prostate or colon cancer and is also developing a saliva test. "There is some resistance from multinational drug companies about preventive medicine," he says. "But we are hoping that through early detection, our simple test will save lives."

Professor Ian Burnett, Dean of the Faculty of Engineering and Information Technology says that Tran and Khoury's project exemplifies the kind of research that UTS wants to support. "They are doing impactful research that is relevant to society," he says.

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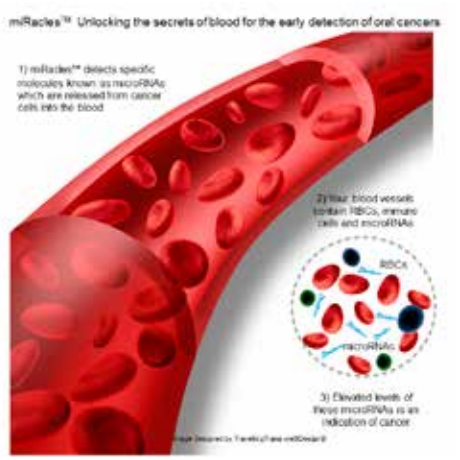

Credit/Caption

TAKING CONTROL OF YOUR HEALTH

by Melinda Ham

Photo: Images For Business

FITNESS JUNKIES, PEOPLE LIVING WITH CHRONIC DISEASE AND OTHERS IN REHABILITATION NOW HAVE SOMETHING IN COMMON; ASSOCIATE PROFESSOR VALERIE GAY AND DR PETER LEIJDEKKERS HAVE CREATED AN APP FOR ANDROID DEVICES TO ENABLE USERS TO PARTICIPATE IN THEIR OWN HEALTHCARE.

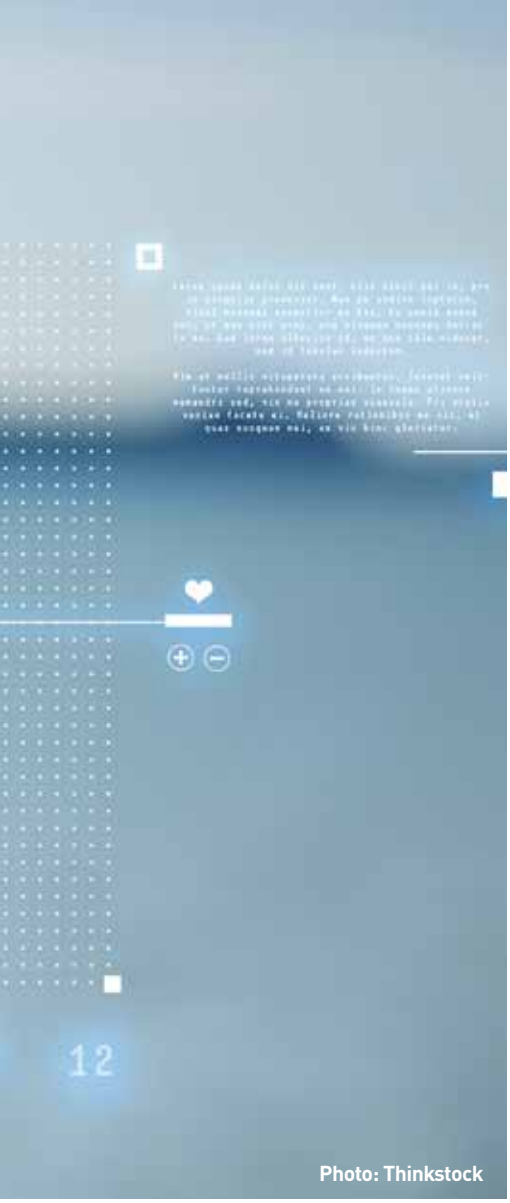

Photo: Thinkstock

Gay and Leijdekkers' app - myFitnessCompanion - offers personalised exercise tracking and biometric data monitoring of heart rate, respiration, body temperature, weight, food intake, blood pressure, cholesterol, asthma, blood glucose, and many other indicators.

"Our app is very political," says Gay. "We are disrupting the power of the traditional medical establishment and giving power to the patient, by providing all that information in one place for them." The app, translated into 15 languages, is available globally on Google Play.

With more than 6,000 myFitnessCompanion users worldwide, about 60 per cent of them are in the US, Leijdekkers says, and in Germany and Russia it is also gaining popularity. "Many people want to take control or minimise doctor visits," he says.

By giving patients up-to-date knowledge about their condition this app can reduce their stress and improve their quality of life.

The researchers are looking to attract more institutional users in Australia, such as nursing homes and holistic health providers, who want to offer the additional service of mobile health monitoring to their patients. "Personal trainers are also using it to provide added value to their clients," Leijdekkers adds.

Family members can even track the progress of each other's fitness and health. "If your child has asthma and is going to travel into the city, you can track air quality; pollution levels and pollen forecasts on your phone and see how it will affect them," Gay says.

The development of their app has a history that stretches back many years; Gay and Leijdekkers are partners in life as well as research. They met 25 years ago when working on an international telecommunications project in Europe, before immigrating to Australia in 1998 – Gay is originally from France and Leijdekkers from the Netherlands.

But a personal tragedy really set them on their current research direction. "When my boss dropped dead of a heart attack aged 40 without warning, I thought to myself; 'with our research capability can't we do something with mobile phones and health to prevent these accidents?'" Leijdekkers says.

So over the next few years, now as lecturers at UTS, Leijdekkers and Gay developed the Personal Health Monitor - software aimed at heart attack survivors who risked suffering another episode.

Linked to a smart phone or android, the software used data collected by a heart monitor which tracked a patient's blood pressure and weight entered by them manually. But if an emergency happened, using GPS, the software also triggered the phone to automatically call 000 for an ambulance, and alert family and bystanders to perform CPR or use a defibrillator until the ambulance arrived.

This innovation won Gay and Leijdekkers one of the year's top five new inventions on ABC television's New Inventors in 2007.

Next the researchers decided to expand their scope to assist chronic disease sufferers with conditions such as diabetes, cardiovascular, respiratory, and musculoskeletal or kidney diseases and even cancer.

"After our previous experience, we realised that there is a fine line between displaying information and giving medical advice," Leijdekkers says. "We are just observers and it is up to the person themselves to act."

In 2011, they released the first version of their current app - myFitnessCompanion, after much multidisciplinary collaboration with hospitals and universities internationally, as well as colleagues in UTS' Faculties of Health and Arts and Social Science, to ensure their communication was targeted and the medical data relevant.

Gay believes that by giving patients up-to-date knowledge about their condition this app can reduce their stress and improve their quality of life. At the same time, it provides a valuable record of the patient's data for clinicians, making diagnosis of problems and ongoing treatment easier.

The researchers' current aims are to continue their research on health and fitness monitoring, expand myFitnessCompanion to a larger client base, and attract investors. U

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"Extreme" corals could hold key to species survival

by Marea Martlew

IT'S NOT OFTEN THAT EXPEDITION RESEARCHERS ARE APPREHENSIVE TO EXPLORE CORAL REEFS. FOR MARINE BIOLOGIST, ASSOCIATE PROFESSOR DAVID SUGGETT, THE STAKES HAVE BEEN HIGH. IN FEBRUARY THIS YEAR, HE AND A TEAM OF RESEARCHERS HAD ONLY ONE WEEK TO LOCATE AND SAMPLE AS MANY CORAL SPECIES AS THEY COULD FROM A NEW CALEDONIAN REEF ECOSYSTEM WITH VERY SPECIAL CONDITIONS.

"The corals we were looking for thrive in relatively acidic and hot mangrove waters; visibility is not great so they often go unnoticed. But that's why we went there, we wanted to examine these unique coral populations to understand how corals can adapt and thrive in extreme environments that potentially represent the future for many reefs worldwide," Suggett said.

Having just returned from exploring the murky waters of a New Caledonian mangrove system, Associate Professor Suggett said the team are now beginning to understand just how far corals can push their limits to survive.

"We are particularly excited since mangrove systems commonly border fringing reefs around the world but have been completely overlooked as possible reservoirs for highly stress-resilient coral populations. Our findings strongly suggest mangroves play further important roles to the long term future of coral reefs, and hence more critical preservation value than ever before."

Photo: Emma Camp

"Most experiments to date suggest that corals will struggle to survive future climates as waters warm and continue to acidify; however, corals thriving within the hot-acidic mangrove systems we have examined suggest they could be more tolerant that previously thought," he said. "We are frantically pouring through our data to find the "smoking gun" that has enabled them to be so stress resilient."

While Associate Professor Suggett said despite their initial observations, which will no doubt carry major value to global coral reef conservation efforts, the team is still being cautious.

"Whilst it is tempting to be optimistic from our findings that corals can adapt to climate change-like scenarios, we have a long road ahead to understand the complex mix of conditions that actually allow corals to thrive within hot-acidic mangrove waters".

The expedition is also a joint initiative between the University of Technology Sydney (UTS) and researchers from the IRD (Institute of Research for Development), a French research organisation with a long history of biodiversity and natural resource research in the Pacific region.

IRD senior scientist and expedition coordinator, Dr. Riccardo Rodolfo-Metalpa said this new discovery within mangrove waters further demonstrates the immense biological importance of New Caledonia's coral communities.

"A number of species that dominate on the main coral reef appear to be the same species thriving within the mangroves; in fact, much of the coral cover in the mangroves is dominated by branching corals that are typically considered the most stress sensitive on normal reef systems. Our data is an important new example as to how coral communities could look in the future."

Another expedition researcher Dr. Emma Camp, an Endeavour Research Fellow in the Coral Ecophysiology Processes Team at UTS, has recently explored other mangrove sites in the Indo-Pacific.

"Whilst finding corals in New Caledonia's mangroves is yet more evidence that coral populations can thrive under conditions often considered inhospitable, we have never seen such extreme pH and temperatures, or such incredible coral cover and species diversity - this is a real first", she says.

"Coral species that thrive here are either genetically unique or represent extremely physiologically 'plastic' populations arriving from the main reef; either way, these coral species can clearly tolerate extreme and rapid environmental shifts, and we next plan to use state of the art sequencing techniques to unlock the genetic basis behind their extreme stress resistance".

The UTS team also included visiting scholar Dr Matt Nitschke and C3 PhD candidate Stephanie Gardner who particularly focused on broader sampling across New Caledonia to gain an even bigger picture of species diversity of corals and the microbial communities they can support across extremes.

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Photo: Matthew Nitschke

Global research predicts a poor future for reefs. An important step in reef management is therefore identifying 'refuges'

Solving a nanotechnology riddle

what makes gold atoms stick together

by Rebecca Gallegos and Fiona McGill

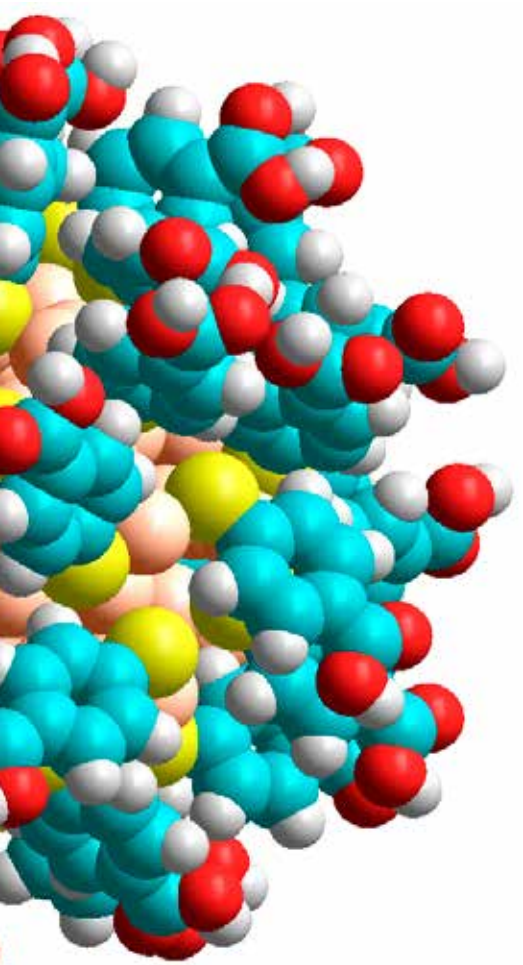

Photo: CREDIT

GOLD IS SPECIAL; COVETED AS AN INVESTMENT, PRIZED AS JEWELLERY AND WITH A DECORATIVE HISTORY THAT DATES BACK THOUSANDS OF YEARS. ORNATE GILDED SURFACES HAVE BEEN FOUND IN ANCIENT EGYPTIAN TOMBS, WHERE GOLD NANOPARTICLES WERE USED AS PAINTS.

Now researchers at the University of Technology Sydney (UTS) have solved the riddle of what makes gold special in today's emerging field of nanotechnology.

Professor Jeffrey Reimers and Associate Professor Mike Ford, from the School of Mathematical and Physical Sciences, led a team that explained the chemical bonding process that occurs during the growth of gold nanoparticles.

Their research, published in March 2016 in the journal Proceedings of the National Academy of Sciences (PNAS), paves the way for applications in biomedical imaging, drug delivery and electronics.

"What makes gold special – and, for that matter, what makes sulphur special – turned out to be the key in understanding how nanoparticles grow," said Reimers, who is a Fellow of the Australian Academy of Science and the 2016 winner of its David Craig Medal for Chemical Research.

"Gold is unique because it doesn't rust, corrode or tarnish, meaning that it generally doesn't react with the things around it. That's why it's known as a 'noble metal'.

"The electrons in gold travel so fast they become heavy, an effect more important for gold than other atoms ... so gold has the appearance of a metal, but with a strange colour and many more properties like those of non-metals such as sulphur."

Developing nanoparticles into non-invasive and targeted treatments for diseases such as cancer is an ongoing challenge for scientists. The key lies in controlling the size and shape of gold nanoparticles, and making them behave in certain ways.

By identifying the significance of the "glue" that binds the surface of the gold nanoparticles to keep potentially destructive chemicals out of range, Reimers and Ford, with collaborators from the Technical University of Denmark and the University of Sydney, have found the key that is critical to customising the properties of nanoparticles.

Gold and sulphur can react together to form strong covalent bonds (a chemical bond where electron pairs are shared between atoms) in compounds known as Au(I)-thiolates.

Reimers said that for 30 years chemists have believed this to be the reason why sulphur glues stick to and protect gold nanoparticles.

"However, our research demonstrates that it is a force known as the van der Walls force - a type of attraction between molecules of quantum mechanical origin - that is responsible for binding sulphur to gold metal and nanoparticles.

"Until one properly and correctly understands the bonding, one cannot correctly describe the chemistry."

Reimers said the way was now open for people to design experiments that really tell how the nanoparticles grow.

"One can only imagine that given this knowledge, things can be made in the future that have never been dreamed about in the past.

"What we have now are better tools for understanding how to do these things, which will pave the way for researchers to invent new generations of gold nanotechnologies."

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What makes gold special in today's emerging field of nanotechnology