In the first study of its kind University of Sydney researchers have found proof that some honeys can be more effective than antibiotics in treating surface wounds and infections.

Unlike antibiotics, which only work on some bacteria, the honeys worked on all of the infectious bugs tested, including one that was resistant to 13 different antibiotics. Critically the bacteria did not adapt and develop resistance to the honey as they do with antibiotics.

The honeys tested by the researchers were variations of Manuka honey and jelly bush honey, from NZ and Australia respectively, both of which are currently available in medicinal versions, but are not widely used in hospitals.

"Most bacteria that cause infections in hospitals are resistant to at least one antibiotic, and there is an urgent need for new ways to treat and control surface infections," said Associate Professor Dee Carter, from the University of Sydney’s School of Molecular and Microbial Biosciences.

"New antibiotics tend to have short shelf lives, as the bacteria they attack quickly become resistant. Many large pharmaceutical companies have abandoned antibiotic production because of the difficulty of recovering costs. Developing effective alternatives could therefore save many lives.

“Our research is the first to clearly show that these honey-based products could in many cases replace antibiotic creams on wounds and equipment such as catheters. Using honey as an intermediate treatment could also prolong the life of antibiotics.”

The common denominator in the honeys tested is that are produced by bees which feed on Leptospermum plants, commonly known as tea trees, found in native Australian and New Zealand bushes.

The honeys worked on pathogens known to have a high level of acquired and/or intrinsic resistance, including superbugs such as flesh-eating bacteria, or MRSA, said A/Professor Carter.

“We don’t quite know how these honeys prevent and kill infections, but a compound in them called methylglyoxal seems to interact with a number of other unknown compounds in honey to prevent infectious bacteria developing new strains that are resistant to it.”

The research has just been published online in the European Journal of Clinical Microbiology and Infectious Diseases, in a paper titled: The unusual antibacterial activity of medical-grade Leptospermum honey; antibacterial spectrum resistance and transcriptome analysis.
Hunting for Antimatter: Nobel Prize in Physics 2008

6:30pm, Thursday 20 August 2009
Slade Lecture Theatre, School of Physics Building,
The University of Sydney Camperdown campus

Why is there something instead of nothing? Quarks, muons, neutrinos, positrons ... why are there so many different elementary particles?

Last year’s Nobel Prize in Physics gives us a deeper understanding of what happens far inside the tiniest building blocks of matter.

Dr Kevin Varvell, recently seen on the “Today” show at the launch of the Large Hadron Collider (LHC), will give an entertaining overview of the science behind last year’s Nobel Prize in Physics

Dr Kevin Varvell is a Senior Lecturer in the School of Physics. After being fascinated by the subatomic world as an undergraduate in Perth, he obtained a DPhil in the subject in the UK and has since then been chasing the secrets of the fundamental building blocks of matter through experiments at CERN, Fermilab and KEK.

RSVP: Lara Davis, outreach@physics.usyd.edu.au

Small Step, Giant Leap: Celebrating Apollo at 40 Exhibition

20 July 2009 – 10 September 2009
SciTech Library, Jane Foss Russell Building,
The University of Sydney Darlington campus

Combining contemporary artefacts and memorabilia, this display will present the history of the Apollo Project and explore the relationship between the US space program and the University of Sydney’s School of Physics.

Saving your skin: the science of reconstructive surgery

5:30pm, 16 September 2009
Eastern Avenue Auditorium, Eastern Avenue Complex
The University of Sydney Camperdown campus

Find out in this fascinating lecture about the amazing technologies being pioneered to assist in the body’s ability to heal itself and generate new skin and tissue. Hear from leading burns specialist and reconstructive surgeon Dr Peter Maitz as he discusses the challenges in burns treatment and then learn all about the science behind the amazing, self-assembling elastic tissues being engineered by Professor Tony Weiss and his team, in the effort to improve the quality of life for burns victims.

A cocktail reception will follow the lecture.

Bookings essential: ssf@science.usyd.edu.au or 9351 3021

Professor Dietmar Müller awarded inaugural Australian Laureate Fellowship

15 inaugural Australian Laureate Fellowships were announced by the Minister for Innovation, Industry, Science and Research, Senator Kim Carr, on Monday, June 22. Each is worth around $2.7 million. One of three University of Sydney Laureate Fellows is Professor Dietmar Müller from the School of Geosciences.

Based on the Fellowship Professor Müller will create a Virtual Geological Observatory, exploiting the connection between deep earth and surface processes over the past 600 million years.

The observatory will enable the application of leading edge technologies to see into the Earth in four dimensions.

“This project will allow the unravelling of the driving forces of shifting coastlines and the formation of deep-Earth resources,” said Professor Müller. “Open-source simulation and data-mining tools will be integrated with the observatory to explore associations between hydrocarbon and mineral deposits, and time-dependent plate boundary kinematics and dynamics,” he said.
Once you get a bunch of hot rod motorheads together, sooner or later, the talk will turn to the invention of the car powered by tap water.

Apparently, in the recent or distant past, a poorly defined consortium of evil politicians and/or car manufacturers and/or oil companies suppressed this marvellous invention to protect their own interests.

Even conspiracy theorists who don't drive believe this one.

Yes, the word was that all you had to do was to make some cheap modifications to the engine or carburettor or fuel injection system, and you could run your internal combustion engine by pouring water into the fuel tank.

But there's a very simple and fundamental reason why you cannot power a car by burning water in the engine.

The reason is that the water has already been burnt, and the chemical energy has been taken out!

Let me explain. When you burn coal in a furnace, the chemical reaction gives you carbon dioxide and heat. You can use the heat from the combustion to turn water into high pressure steam, and then use that steam to push the blades of a turbine to make electricity.

If you go back to the coal furnace, you will find some ashes there. These ashes are the leftovers from burning the coal. You cannot burn those ashes again. They have already been burnt.

The situation is the same for water because the water has already been burnt.

When you burn hydrogen and oxygen in a chemical reaction, you get water and heat.

When each NASA space shuttle thunders upward into space, its external tank carries some 617 tonnes of liquid oxygen and about 103 tonnes of liquid hydrogen.

They are burnt together to make about 720 tonnes of water, which is instantaneously turned into steam by the heat of the chemical reaction.

This steam builds up inside the rocket engine with enormous pressure, and comes out through the nozzle of the rocket engine. This nozzle is pointing down to the ground.

And so, thanks to the rule that for every action there is an equal and opposite reaction, the space shuttle is pushed upward.

Once it comes out of the nozzle, the steam coming out of the space shuttle engines cools down and turns into droplets of liquid water, which appear as a long skinny vertical cloud behind the rising space shuttle.

Water is just wet ashes. It has already been burnt. It can't be burnt again! This is the same for the coal ashes. They have been burnt, so they can't be burnt again.

So you can't get any more chemical energy out of that water, because it has already been burnt.

But there is a roundabout way that you can get energy out of that wet liquid water. All you have to do is place the water in a tank that has a metal electrode at each end and shove some electricity into those electrodes.

The energy in the electricity will split the liquid water (H2O) into bubbles of hydrogen gas at one electrode, and bubbles of oxygen gas at the other electrode.

Then you can combine the hydrogen gas and oxygen gas to make water, and heat energy. Surely that will work?

Yes, it will work. That is one way to get energy out of water. But the laws of thermodynamics stop you from getting energy for nothing.

By the way, the casual or layman's form of the three laws of thermodynamics are:

1. you cannot win
2. you cannot break even; and
3. you will always lose.

So yes, you can get energy from the hydrogen and oxygen you get by splitting water with electricity. But, you have to put more energy in than you get out.

For example, if you put in 100 units of energy to split the water into hydrogen and oxygen, you will get back only 80 units of energy when you recombine that hydrogen and oxygen.

Luckily for the conspiracy theorists, there are other sources of energy besides chemical energy. These include gravitational energy, kinetic energy, heat energy, electrical energy, magnetic energy and nuclear energy.

However, nobody has yet succeeded in using any of these kinds of energy with water to propel a car with an internal combustion engine.

So maybe it's time to hose down such far-fetched ideas. us.
Recently, she and her team found some devils in northwestern Tasmania with different MHC genes and put them in a captive breeding program to increase the genetic diversity of captive animals. She is also trying to find out whether some of these animals with different MHC genes can fight the tumour and improve their chances of survival.

"Once genetic diversity is gone, species are not able to respond to disease, and epidemics, such as the one we are seeing in the devil, can take over."

"By carefully selecting the animals we bring in and breed in captivity, we can keep genetic diversity for future release into the wild. If we succeed, this could change how the world conserves threatened species, especially ones that are inbred and live on islands."

Other species that could benefit from Kathy's knowledge are the much loved koalas living on Kangaroo and French Islands and platypuses on King Island.

Science is not just work, for Kathy, it's a joy.

"Science is lots of fun. Many people think of science as being quite isolating - but the best thing about my job is the people. I work with the most inspiring people! My research students are superstars. They work hard, are passionate and so enthusiastic. They make coming into work every day lots of fun."

She calls herself a 'dorky natural blonde', but geneticist Dr Kathy Belov from the Faculty of Veterinary Science at the University of Sydney is the world's superhero when it comes to fight a hideous contagious cancer that could destroy Australia's wild Tasmanian devils.

"It sounds dorky - but research really is a hobby and a passion of mine," Kathy said. And it's just as well, because within 25 years, all Tasmanian devils in the wild may die if we don't come up with a way to stop the spread of the contagious cancer, Devil Facial Tumour Disease. Once there were 150,000 devils roaming the island, now there are now less than 50,000.

Kathy and her team of researchers are by far our best hope at saving these marsupials. She worked out that the devils are affected by this cancer because they are essentially clones, sharing the same genes. What's more, she found out that the tumour has similar genes to the devil, which means its immune systems doesn't 'see' the cancer cells invading and does not attack them.

"One of the main reasons the devils are so likely to get this disease is that their numbers have dropped to very low levels in the past and they have lost their genetic diversity," Kathy said.

"Devils have been through at least three population crashes which were followed by inbreeding - where they have to breed but are quite closely related. So you can end up with more devils, but they all come from a very small gene pool."

Kathy's research showed that the devil's lack of genetic diversity meant that important immune genes that help the body fight infectious disease, called Major Histocompatibility Complex (MHC) genes, also lacked diversity.

Eight University of Sydney people have been named finalists for the prestigious 2009 Australian Museum Eureka Prizes.

Professor Bruce Sutton, Professor and Chair of Academic Board, is a finalist for research that untaps the potential of water that would normally be too salty for agricultural irrigation.

Kathy Belov, a geneticist in the Faculty of Veterinary Science, is a finalist in the People’s Choice category for her work identifying the link between the genetic make-up of Tasmanian devils and contagious facial tumours threatening the species’ survival. See previous story.

Professor Marcela Bilek, Professor David McKenzie, Professor Cristobal dos Remedios and Professor Anthony Weiss are finalists in the ARC prize for interdisciplinary research for their work which combines physics and biology to create technology that binds active biomolecules to any synthetic surface.

Professor Christopher Dickman is a finalist in the Sherman Prize for Environmental research, recognising his "scientific commitment to protecting the delicate inhabitants of Australia’s iconic desert landscapes."

Professor Richard Christopherson has been recognised for his "invention of an antibody microarray (DotScan) consisting of hundreds of microscopic antibody dots on a slide, enabling rapid and cheap profiling of the cell surface of leukaemias for diagnosis."

The Australian Museum Eureka Prizes are presented annually by the Australian Museum. The prizes recognise excellence in scientific research, science leadership and innovation, science journalism and communication and school science.

The will be announced in Sydney on 18 August.
A walk through a cemetery is an evocative journey telling tales of human life come and gone, but to weathering erosion specialist Associate Professor Deirdre Dragovich, graveyards can also tell a story about climate change and pollution.

A/Professor Dragovich from the University of Sydney’s School of Geosciences is now recruiting members of the general public to collect data from graveyards for the Global Gravestone Project, which began last month. The project aims to map the location of graveyards around the world and then measure the weathering rate of the marble gravestones within them.

"Weathered marble surfaces represent the cumulative environmental history of their location," said geomorphologist A/Professor Dragovich. "Because marble headstones are freshly cut when they are placed in a cemetery, the weathering ‘clock’ is effectively set to zero."

The Global Gravestone Project is part of the EarthTrek Global Citizen Science program, whose tag line is “The community is part of the solution” and which is being run in conjunction with the Geological Society of America. It is open to anyone over 13 years of age who has an interest in science, and who also has a Global Positioning Unit (GPS).

The methods used to measure the weathering of the marble headstones include observing and measuring the lead lettering (which weathers only slowly), and measurement of the varying thickness at the top, middle and the bottom of the headstone.

The data collected by the participants will be analysed to show the changes in weathering rates influenced by acidity in the environment in specific locations over time. The acidity is affected mainly by air pollution which increases weathering rates. It may also be possible to detect changes in rainfall over time, thus providing a measure of climate change and other factors, and could be used as a measure of changes in climate and pollution levels.

Participants have already registered about 70 American cemeteries in the US, said A/Professor Dragovic.

Once data is collected by the community, it can be uploaded to the Global Gravestone Project website.

"This is the first time we will be able to get a global view of rainfall patterns and pollution in relation to weathering," said A/Professor Dragovich.

"We have been observing gravestones for a while, but previously everyone just used to work in their local area. By using the internet to recruit participants from the general public, we will be able to collect data from all over the world - the US, the UK, Europe - wherever people can see the Gravestone Project website."

To read full instructions on how to collect data from marble gravestones go to the Global Gravestones Project website - http://www.goearthtrek.org/Gravestones/Gravestones.html
Research by University of Sydney scientist, Dr Mike Letnic, has shown that Australia’s top predator, the dingo, plays an important role in maintaining the balance of nature and that reintroducing or maintaining existing dingo populations could increase biodiversity across more than 2 million square kilometres of Australia.

Dr Letnic, from the School of Biological Sciences, showed that dingoes have a positive effect on Australian native mammals by suppressing populations of other introduced species, particularly foxes.

The research, published in the journal Proceedings of the Royal Society B, contradict the long-held belief that dingoes are invasive predators that pose a threat to native wildlife.

Dr Letnic’s study consisted of biodiversity surveys along the length of the dingo fence, which is the longest fence in the world and runs from the coast in South Australia, along the NSW border, and through Queensland to keep dingoes out of the south east of Australia.

Where dingoes had been exterminated, Dr Letnic found increased abundances of introduced red foxes and herbivores, while small native mammals and grasses were lost.

‘Dingoes appear to suppress the impacts of red foxes, so we predict that maintaining or reintroducing dingo populations would benefit threatened native mammals across more than 2 million square kilometres of Australia,’ said Letnic.

The dingo, Australia’s largest predator, is an alien introduced less than 5,000 years ago and is subject to large-scale extermination to protect agricultural animals such as sheep. The status of dingoes as a native or introduced species in Australia is ambiguous because of their recent arrival.

‘Alien predators often have catastrophic effects on ecosystems and are thought to be more harmful to biodiversity than native predators,’ explained Dr Letnic.

‘Since European settlement of Australia there has been a mass extinction of mammals weighing less than 10 kg. These extinctions are thought to have been driven by a number of factors, particularly predation by introduced red foxes,’ said Dr Letnic.

‘Our research suggests that maintaining or restoring dingo populations may be a useful strategy to reduce the predatory impacts of foxes on small and medium sized mammals.

‘This supports the notion that the dingo’s functional role as top-predator is ecologically more significant than the classification of this species as an undesirable alien pest. To put it simply the dingo is now nature’s keeper,’ said Dr Letnic.
The Faculties of Science have been preparing for a number of changes to our undergraduate degree offerings for 2010. These are designed to provide students with more choice with their UAC preferences and greater opportunity at University. The new degrees are:

Bachelor of Environmental Systems
3 years fulltime study
The Faculty of Agriculture, Food and Natural Resources will offer a premier environmental degree that complements other, more organism-focused degree courses at the University of Sydney. This degree differs from other environmental degrees in that it has a clear focus on building knowledge and skills across disciplines. Core units span plant science, hydrology, soil science, biosphere-atmosphere interactions and ecology whilst offering majors in agricultural systems and natural terrestrial systems. This exciting degree encourages solutions-based learning tackling the major issues of today such as food security, water, carbon emissions, climate change and flow-on effects such as drought and fire. This degree offers students a unique opportunity to build a science and economics skill-set and prepare for a broad range of careers and future studies.

Bachelor of Science/Master of Nutrition and Dietetics
5 years full time study
The Bachelor of Science/Master of Nutrition and Dietetics provides a clear pathway of study for top students wishing to pursue a career in nutrition and dietetics. During the Bachelor of Science students complete units of study in biochemistry, molecular biology, and human physiology that are necessary prerequisites for accreditation by the Dietitians Association of Australia (DAA). The revised degree structure for nutrition allows students the flexibility to explore a range of other subject areas during their undergraduate degree. The Masters course combines research, specialised study and professional placements in the field of nutrition and dietetics. After completing the Master of Nutrition and Dietetics students will be eligible for membership as an accredited nutritionist or accredited practicing dietitian with the DAA.

Bachelor of Psychology
4 years full time study/ 8 years part time study
From 2010, the University will have one psychology degree, the Bachelor of Psychology. Students will still have flexibility in whether their degree is humanities or science based through the offering of two streams: arts or science. The arts stream does not require study of mathematics units in first year.

Bachelor of Liberal Arts and Science
3 years full time study/ 6 years part time study
A unique new degree at the University of Sydney, the Bachelor of Liberal Arts and Science (BLAS), provides you with a breadth of knowledge in the humanities and the sciences and depth of knowledge in one of these areas. In addition, through a Liberal Studies stream it develops specific skills which have been identified by employers as desirable in a wide range of careers. The Liberal Studies stream of the BLAS is designed to provide you with communication and analytical skills as well as an understanding of ethical issues so important in today’s society. While the degree will produce highly employable graduates, it will also provide a foundation for entry into a research career via an Honours year or a Master’s by Research, or into a postgraduate coursework degree for further specialisation.
An excerpt from Sydney Science, a book charting the discoveries and research of the University of Sydney's Faculty of Science.

The new frontiers of cancer research, protein profiling, chemical therapeutics, microscopy and psycho-oncology, are transforming the way we approach cancer both in the lab and clinic. Whether it’s a focus on providing optimal care, developing effective therapeutic agents or a better understanding of what happens at the cellular level of cancer, our researchers are out to know all they can about this leading killer.

**A personal attack**

Professor Richard Christopherson, Director of the Sydney University Proteome Research Unit, and his team are developing new diagnostic techniques. A breakthrough in protein profiling of cancers that should enable personalised medicine.

2D electrophoresis separates proteins by their isoelectric point then mass-to-charge ratio, enabling Christopherson to identify thousands of proteins in melanoma cells. A process that has uncovered a source of melanoma drug resistance, where higher levels of the proteins Cystatin B, manganese superoxide dismutase and B cell enhancing factor, interfere with cell death, dampening the effects of chemotherapy. “Identifying the source of this resistance is a step towards refining chemotherapy to suit each patient,” explains Christopherson.

Protein profiles can also be generated by DotScan microarrays, a technique developed by Christopherson. A mosaic of microscopic dots of antibodies reacts with a patient’s sample to reveal a profile of marker proteins on the surface of cancer cells.

The extensive surface profiles obtained using DotScan microarrays should enable diagnosis, prognosis and determination of drug sensitivity without additional information. Christopherson is enthusiastic about what this means for cancer patients worldwide. “This technology is a powerful adjunct to current cancer diagnosis. The more we know about the pathology of a cancer, the greater our chance of providing optimum patient care.”

There are 30–40 common types of leukaemia, each with a distinct pattern on DotScan. Samples from 796 people, taken from hospitals in Australia and the US, have been analysed to generate an extensive database of surface protein profiles on leukaemias.

Chronic lymphocytic leukaemia (CLL) is a research focus for Christopherson. DotScan can provide the power to distinguish between indolent and terminal CLL. “At the moment there’s no reliable way to distinguish between the two, which makes advocating aggressive treatment difficult. A version of DotScan developed for CLL will provide a means of matching cancer patients with the appropriate treatment.”

“Each leukaemia is caused by a different combination of up to 90 mutations, so each leukaemia should be treated as an individual disease. DotScan provides a new, systematic method of classification and could potentially identify new types of leukaemia, whilst tailoring chemotherapy to individuals.”

The DotScan technology is covered by international patents and is produced and distributed by the company Medsaic. Focusing initially on two applications, leukaemia and solid tissue tumours, it’s hoped that Medsaic will increase the precision of diagnoses as well as improve medical access to pathology in rural and remote locations.