

# Improve your health with CSIRO's new barley



After nearly 12 years of research, CSIRO has produced BARLEYmax™ – a natural wholegrain developed specifically to provide enhanced nutritional benefits for Australians.

In the late 1990s, CSIRO researchers developed a diverse collection of new barley variants in a project originally aimed at understanding the role of plant hormones.

The potential of this collection, together with CSIRO's research on understanding the genetic pathways of starch biosynthesis to create new barley types, was recognised and barleys with diverse starches and other dietary fibre components were identified. From this work came BARLEYmax – a grain with high levels of resistant starch and the potential to improve health.

Under the Food Futures National Research Flagship, an extensive program of experimental studies and human trials found a range of foods with BARLEYmax as their key ingredient had a low glycemic index and produced positive changes in a range of biomarkers of bowel health.

With twice the dietary fibre of current grains, four times the resistant starch and a low glycemic index, BARLEYmax offers many potential health benefits for the consumer. It also improves texture and enhances flavour with a pleasant 'nutty' taste distinguishing it from other grains.

BARLEYmax grains are having impact along the value chain (by providing speciality grains on farm that command premium prices, providing new opportunities in food product manufacturing, and delivering potential health impact for consumers) and have the potential to add significant value to the Australian economy, well in excess of \$100 million per annum.

Two BARLEYmax breakfast cereals, developed by an Australian food manufacturer, are now available on supermarket shelves across Australia and a range of additional products is planned.



BARLEYmax is low GI and has twice the dietary fibre and four times the resistant starch of current grains.  
Credit: Carl Davies

**'BARLEYmax offers many potential health benefits for the consumer.'**

## CSIRO's WLAN now used in electronic devices worldwide

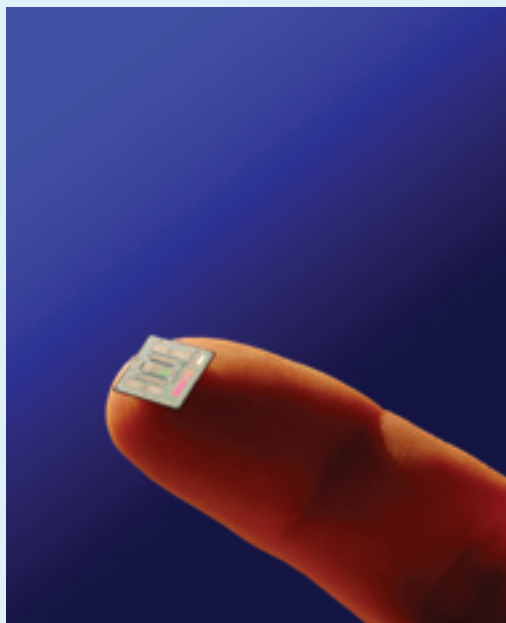
CSIRO's pioneering work in radio astronomy led the way to what is now the most popular way to connect computers without wires. That work involved complex mathematics known as 'Fast Fourier Transforms', as well as detailed knowledge about radio waves and their behaviour in different environments. Indoor environments are particularly difficult for the rapid exchange of large amounts of data using radio waves.

To solve these problems, CSIRO invented the technology behind most high-speed wireless local area networks (known as Wi-Fi). The technology underpins the wireless communication system found in almost every laptop computer and associated wireless device produced today and is used in homes and offices around the world. The invention and the widespread adoption of the technology has enabled a global revolution in mobile computing and in the way we live and work.

Following settlements of patent litigation in the US, CSIRO's patent is now licensed to 15 companies, including Hewlett-Packard, Intel, Dell, Toshiba, ASUS, Microsoft and Nintendo, under confidential terms. The revenue arising from these settlements to October 2009 was approximately \$205 million.

Forecasters\* predict that there are likely to be more than three billion devices sold worldwide over the next several years using the technology invented by CSIRO scientists.

\* Source: In-Stat LLC *Wireless LAN Market Estimates and Forecast by Device 2009–2014*



The 'Fast Fourier Transform' processor chip was originally developed in the mid 1980s to help radio astronomers find exploding black holes in the universe. That early work led to CSIRO inventing a technology that is now used in almost every wireless local area network (Wi-Fi) device in the world, including laptop computers, smart phones and game consoles. Credit: Denis Redfern

## CarbonKids: teaching kids about climate change



In August 2009, students and teachers from 16 Canberra schools gathered at Forrest Primary School to celebrate the national launch of CSIRO Education's new CarbonKids education program. CarbonKids is a program for schools committed to tackling climate change. The program offers a range of ideas and activities for the early, primary and middle years of schooling. The program was piloted in 26 schools across Australia with funding support from Shell.

Like most of the schools involved in the trial, the Canberra schools integrated a selection of climate change curriculum resources into their existing school curriculum framework, putting a climate change focus on existing units. Students also developed an understanding of how to reduce greenhouse gas emissions in their schools and local communities and how planting trees absorbs carbon from the atmosphere. The schools engaged students, teachers, parents and other members of the community to evaluate their carbon footprint and develop a better understanding of the science behind climate change.

An external evaluation showed that the CarbonKids program 'met a significant need in schools for improving teaching and learning about the science of climate change and its implications (such as carbon reduction and sustainability)'. Through a heavy focus on critical literacy, numeracy, cultural awareness and open-investigations, the program inspired values, skills and a deep understanding of our need to mitigate and adapt to the effects of global warming.

With funding from Bayer, CarbonKids will engage an additional 90 schools and continue to develop new classroom resources for students to discuss and investigate a range of social, economic and scientific issues related to climate change.



Students involved in the sequestration of carbon.  
Credit: The Department of the Environment, Water, Heritage and the Arts

**'...the program inspired values, skills and a deep understanding of our need to mitigate and adapt to the effects of global warming.'**

## CSIRO and social media



During 2009, CSIRO launched an integrated social media presence to introduce the Organisation to a diverse new audience and support the communication of CSIRO science in an easily accessible and engaging format.

Comprising a Facebook Fan page, YouTube Channel, and podcast and vodcast series, CSIRO's social media is used to promote the breadth of our research along with other activities, such as education and recruitment. All the social media platforms are integrated to maximise reach and draw people to each channel and CSIRO's website. While social media allows CSIRO to reach people of all ages, it offers a particular opportunity to reach younger audiences – our future scientists and decision makers.

With more than 3,377 fans, the Facebook Fan page continues to grow in popularity and a vibrant community with a genuine interest in

CSIRO has started to emerge. CSIRO's YouTube channel has so far attracted more than 150 subscribers and over 120,000 video views, while podcast downloads for the year reached 362,665 and vodcast downloads reached 33,448.

**'Great vodcasts. Well made and great watching. Keep it up.'**

**'Thank you indeed for posting so much useful research here on YT, a great way to spread information of significance.'**



CSIRO's in-house journalist, Glen Paul, at work in the studio. CSIRO's podcasts were downloaded 362,665 times in 2009–10 and are popular on iTunes. Credit: David McClenaghan

## Reducing the Australian Animal Health Laboratory's environmental footprint



CSIRO's Australian Animal Health Laboratory (AAHL) in Geelong, Victoria has made significant changes to the way the facility operates in order to reduce the facility's environmental footprint. Prior to the upgrades, AAHL's air intake system ran continuously with fans drawing on a significant amount of power to function. Old steam boilers and hot water generators were inefficient, with water consumption being of major concern.

Over a five year period, a multi-million dollar project focused on progressively upgrading and replacing the facility's engineering plant and equipment whilst concurrently maintaining AAHL's functional operations. Various modifications to extend the life of the facility by installing state-of-the-art equipment were undertaken.

AAHL's heating system now has an average operating efficiency of 75 per cent compared to the original steam boilers which had only

50 per cent. Fans now operate with a variable speed drive at the minimum speed necessary to provide the required air flow and pressure, significantly reducing energy usage. AAHL recently announced a natural gas consumption saving of more than 25 per cent over a five year period. Overall, equipment upgrades have resulted in a 40 per cent reduction in the facility's energy and gas consumption helping us reduce our environmental footprint.



The Australian Animal Health Laboratory at Geelong, Victoria. Credit: CSIRO

# CSIRO's approach to climate change adaptation

Australia is particularly vulnerable to many of the climatic changes projected by CSIRO and other international scientists. Our water supplies, coastal settlements, agriculture and natural ecosystems are especially affected by climate change. In fact we have been assessed as one of the developed nations most vulnerable to climate change.

CSIRO's Climate Adaptation Flagship brings together a wide range of skills and capabilities to help Australia adapt to a changing climate. Our researchers provide the scientific basis to support sound adaptation decisions by government, industry and communities. We aim to minimise the negative consequences of climate change and climate variability and take advantage of new opportunities that may arise.

For agriculture our research is developing strategies for mixed cropping and grazing systems Australia-wide to adapt to projected climate change and other business pressures. By combining information from real mixed cropping systems with expected climate change impacts, farmers can identify management options to offset negative impacts.

A Flagship Collaboration Cluster is assessing the benefits of coastal adaptation. The South East Queensland Climate Adaptation Research Initiative is investigating a range of options to reduce the population at risk of inundation in low lying coastal areas.

Flagship scientists led a project to develop the Marine Climate Change Impacts and Adaptation Report Card for Australia. It communicates observed and expected changes together with key adaptation options for environmental and resource managers and anyone with recreational and financial interests in our coasts and oceans.

By equipping Australia with practical and effective options to adapt to climate change and variability the Flagship aims to create \$3 billion per annum in net benefits by 2030.



Coastal inundation will be more frequent as sea level rises. Credit: Liese Coulter

# CSIRO research supports the Murray-Darling Basin



Australia's Murray-Darling Basin, which generates 70 per cent of Australia's irrigated produce, is under enormous stress due to past water-allocation decisions, prolonged drought, and climate change, resulting in a loss of water security for communities and the environment. The Basin supports agriculture production of the order of \$15 billion annually and is the primary water supply for urban centres, including Adelaide and Melbourne.

The Murray-Darling Basin Authority is developing a Basin Plan to manage water resources and ensure there is sufficient water available to make sure key environmental assets and functions of the Basin are not compromised, while seeking to optimise social and economic outcomes.

CSIRO has a long history of undertaking important research in the Murray-Darling Basin to understand the region's ecology, support improved water management and to support the development of the Basin Plan.

In 2008, CSIRO's Murray-Darling Basin Sustainable Yields Project provided the world's first rigorous assessment of the potential impacts of development and climate change on surface water and groundwater availability across the Basin. This research has provided governments, industry and communities with an unprecedented level of water information to guide future resource planning, management and investment.

CSIRO researchers are also undertaking research:

- on the potential impacts of changes in water availability on Indigenous communities of the Basin
- to investigate the relationships between watering strategies and the health of vegetation, fish and other animals in the Basin to help water managers to improve and justify delivery of environmental water
- on groundwater resources in the Basin to support its future management
- on social and economic affects of changing water availability
- to investigate the impact of a changing climate on future water resources of the Murray-Darling Basin.



The Murtho Floodplain near Renmark, South Australia. Credit: Tanya Doody

# Australian Black Tiger prawn boosts local industry



CSIRO scientists have collaborated with the Australian prawn industry to develop a new prawn that is producing record yields and can be sustainably farmed. With around 50 per cent of all prawns in Australia currently imported from other countries such as China and Vietnam, this research will dramatically improve the production efficiency and profitability of locally produced seafood.

After ten years of research, the new Australian Black Tiger prawn is a major boost for both the local prawn industry and consumers wanting to buy Australian seafood. This Food Futures National Research Flagship project has combined selective breeding techniques with DNA fingerprinting to develop a naturally bred Black Tiger prawn that captures the best features nature can provide.

The new breed is grown and farmed in 'drought-proof' saltwater ponds, has improved growth and survival rates and greater disease resistance combined with improved taste, texture and colour. Its high yields could also play an important role in securing food supplies, both in Australia and globally, through the production of a more sustainable and high yielding source of healthy protein.

The average harvest yield from Australian Black Tiger prawn farms is five tonnes per hectare. The average yield of the new breed developed by CSIRO and Gold Coast Marine Aquaculture in 2010 was 17.5 tonnes per hectare, with 30 per cent of the ponds producing more than 20 tonnes per hectare – a world record yield result for Black Tiger prawns.

If the entire Australian Black Tiger prawn industry adopts this new breeding technology, it will increase the industry's production from 5,000 tonnes to 12,500 tonnes and add \$120 million per annum to the value of the industry by 2020.



The new breed is providing a real boost for the prawn farming industry in Australia resulting in job growth, more profitable and productive business, and fresher home-grown product. Credit: Darren Jew



# Flagship Collaboration Fund



The Flagship Collaboration Fund is unique in CSIRO. The Fund provides research capability, sourced from the National Innovation System and internationally to help the National Research Flagships meet their goals.

During 2009–10, the Fund reached its most significant year of expenditure of \$17 million. To date, \$56 million has been disbursed and \$96 million committed from the original \$114 million provided by the Australian Government.

Four new research Clusters were approved during the year involving 12 national and four international universities which represented a \$12.5 million three year investment, with matching investment from partners. Additionally, \$1.4 million worth of new projects and Visiting Fellowships to universities was supported, as well as 25 student scholarships.

Early in 2010, a Cluster Science Day was hosted to bring together university Cluster Leaders to celebrate their work and achievements in support of the Flagships. Participants praised the Fund as a mechanism for encouraging collaborative research and providing university access to CSIRO and issues of national importance.

A review of the Fund was also undertaken early in 2010. An external expert review panel focused on strategic and operational aspects, including an intensive program of discussions with stakeholders. In its report, the panel strongly endorsed the scale up and continuation of the Fund to the effect of doubling the funding available to reach full potential. The panel was unanimous in agreeing that the broad objectives for the Fund remain critical for contributing to the National Research Flagships Program, building capability across the National Innovation System and building longer-term research collaborations. See Appendix I, page 176 for information on our Flagship Collaboration Fund Clusters.



Dr Tom Hatton (Director, CSIRO Wealth from Oceans Flagship) speaking at the launch of the Coastal Collaboration Cluster at Cottesloe Surf Life Saving Club on 21 April 2010. Credit: Alana Blowfield

**'Participants praised the Fund as a mechanism for encouraging collaborative research and providing university access to CSIRO and issues of national importance.'**