

# Flagships: the Admiral's view

**In the vastly altered political, economic and environmental playing-field of the 21st century, Australia has a deep need for sustainable growth and wealth generation. And with the nation experiencing a slowdown in population growth and a declining resource base, some innovative solutions need to be brought to the fore. To tackle these challenges, CSIRO has launched one of the largest scientific research programs in Australia's history, the National Research Flagships. It is not surprising that a strong theme of sustainability runs through the Flagship Programs. Graeme O'Neill interviewed their architect – some might say their admiral – eminent ecologist Dr Graham Harris.**

DR HARRIS says the 'flagships' concept was born soon after Dr Geoff Garrett became CSIRO's Chief Executive in January 2001. 'He asked me what were the major national challenges facing Australia, and what was CSIRO doing about them?'

At the same time, Dr Bruce Hobbs, CSIRO's Deputy CEO, was preparing his 2001 Brodie Hall Lecture on the major challenges of developing a sustainable economy in Australia.

From our discussions, says Dr Harris, emerged a set of national research priorities that has 'stood the test of time', and a guiding philosophy for the future: CSIRO's response would be integrated across the organisation, and externally inclusive – it would be very much a 'Team Australia' approach.

'It was really important to be outward-looking, to involve other research agencies and institutions,' Dr Harris said. 'Who did we

need to partner on the outside to make a difference?'

It was also clear that, to address these challenges, Australia would have to generate greater wealth. 'With our restricted resources, we need the best bang for our buck,' Dr Harris said.

The Flagship Research Programs provide a synoptic view of the research landscape – but one in which the linkages between all levels of research, and research disciplines, are more clearly visible.

## **Preventative Health**

Not even massive immigration can prevent Australia's population peaking at around 25 million by 2050, and the nation's average age will rise inexorably as birth rates decline, says Dr Harris.

There will be fewer, younger taxpayers to support the rising health costs associated with diseases of ageing. There must be

a shift towards preventative medicine – 'P-medicine' – to keep Australians healthy and productive as they age.

'If we can add 10 years to the productive life of Australians, through early diagnosis of medical problems, and preventative health measures, it would avoid medical budget blowouts, and have an enormous impact on GDP,' Dr Harris said.

'It's in the national interest to have more people leading healthy, but also more fulfilling lives. That means getting in early, looking at people's propensities for particular diseases, and heading them off.'

'The drastic decline in coronary heart disease when we changed from eating animal to vegetable fats shows it can be done.'

The future of preventative medicine lies in gene- and protein-based diagnostics and therapeutics, and in using the power of information technology to link genetic susceptibilities to environmental factors involved in disease.

'With degenerative diseases like Alzheimer's and arthritis, we can't do it alone – we're working closely with the NHMRC and clinicians, and studying population

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databases, trying to understand the aetiology of these diseases.

'Colon cancer, one of the most common cancers, is one where we can get a maximum bang for our buck – we believe we can influence it through diet, but we don't yet know how.'

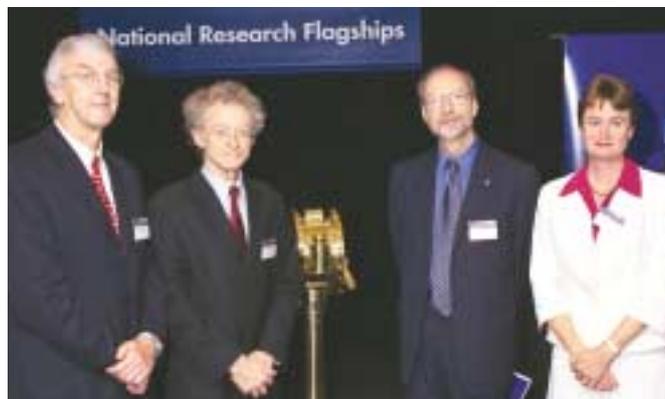
## **Wealth from the Oceans**

Dr Harris says the ocean resources project is still in the early development phase. 'We need to know how to evaluate and make better use of our marine resources.'

'To develop better management policies, we need better data and better models. 72 per cent of Australia's territory is under the ocean, and we can't make the same mistakes we made on land.'

## **Healthy Australia**

The Healthy Australia flagship program is largely about remedying old mistakes. It seeks to make Australia's agricultural systems sustainable and profitable, while delivering better environmental outcomes, like flood and drought resistance, healthy rivers and estuaries, and reversing the decline in biodiversity. But the number one priority, says Dr Harris, is to make water a sustainable resource for urban and rural Australia.



**CSIRO Chief Executive, Geoff Garrett; Australia's Chief Scientist, Robin Batterham; Flagships Chair, Graham Harris; Chairman of the CSIRO Board, Catherine Livingstone at the launch of the Flagship Research Program**

The water program will focus on several major regions: far north Queensland's rivers and the Great Barrier Reef; the southern Murray-Darling Basin, the centre of Australian irrigated cropping; the Melbourne metropolitan water system, which has suffered from a long-term decline in rainfall; and the Perth metropolitan system, which is affected by saline groundwater.

'Our initial work is focused on trying to find an effective accounting system for valuing water and its benefits, but the goal is to radically improve the economic, social and environmental benefits we derive from water,' Dr Harris said.

### **Agrifood Top 5**

Dr Harris says the Agrifood Top 5 dovetails with the Healthy Australia and Preventative Health Projects.

Food links human health with the environment, so there are strong sustainability overtones in research to increase the production efficiency and profitability of Australia's top five agricultural industries – wheat, beef, wine, horticulture and cotton.

The tools of the New Genetics – genomics, proteomics and metabolomics – will be applied to develop more productive, better-adapted crops and livestock species. Consumers, and Australian exports, will benefit from new processing technologies which will improve the shelf life, flavour and texture of foods. Nutraceuticals – foods enriched in compounds like cancer-fighting antioxidants, or plant sterols, and monounsaturated fatty acids that ward off cardiovascular disease – will help keep Australians healthy as they age. New separation technologies will recover valuable bioactive compounds from meat and dairy processes.

'We're not going to increase the value of our food exports by doubling our acreage,' Dr Harris said. 'We want to value add and halve our water use.'

### **Leading the Light Metals Age**

Dr Harris says Australia has world class light-metal orebodies and reserves of light-metal ores.

Australia is the world's biggest alumina producer, but it would be far more profitable to export high-value, lightweight, aluminium alloys – 'and we want to become a major global player in magnesium, and a significant global player in titanium.'

The major challenge is to reduce the huge amounts of energy required to transform the ores to metals – the so-called embodied energy in the metal or alloy. Otherwise, the gains in fuel efficiency and reduced greenhouse gas emissions through lightweight alloy engines and vehicle components would simply be transferred to the production and processing phases for the raw materials.

The aluminium industry is locked into existing technologies that offer prospects for incremental gains, but the magnesium and titanium industries are young and ripe for revolution. 'Can we make titanium with half the embodied energy, for example?' Dr Harris said. 'We're looking at some very alternative processing technologies that, if they work, would revolutionise the market for titanium products.'

### **Energy Transformed**

Australia's economy runs on cheap energy, so the quest for more sustainable energy forms must avoid drastic increases in energy costs, says Dr Harris. Geological history left the continent coal and gas-rich, but oil-poor. As the oil begins to run out next decade, alternative fuels for transport will be needed.



Coal can be used in the transition to a hydrogen economy; it must be gasified to release its 'clean hydrogen', and its carbon sequestered, to minimise greenhouse emissions.

Local-scale, distributed energy systems would eliminate the enormous heat-energy losses from trunk powerlines, while co-generation systems could supply both electrical power and airconditioning to large buildings. Research into compact ceramic fuel cells and hybrid propulsion systems offer 'huge synergies' with advances in light metals research. 🌐

