In this issue

Recent changes to New Zealand's RS&T sector announced by the National-led governmement have been described as the most significant for 20 years. In this issue of *Science Review* we have three contributions that provide constructive commentary on aspects of these changes

In the first, *Creating engines of growth*, Jacqueline Rowarth discusses the main recommendations of the government's CRI Taskforce report, and how the CRIs can become the desired engines of growth for the economy. Jacqueline considers the factors involved in research governance and leadership which will be critical in creating the appropriate management for the engines to function and create the desired growth. She quite rightly points out that the onus is on the scientific community to help MoRST and FRST, as well as the CRI boards, to make the right decisions about their future.

Commenting on the merger of MoRST and FRST as a step towards simplifying the New Zealand science management system, Jacqueline notes the following from a DEMOS review of a creative organisation in the UK – 'conceptual simplicity is the best response to organisational and contextual complexity'.

A widely-held view is that if New Zealand wants to get wealthier, it needs increased productivity.

In our second paper, *Recognising scientific entreprenuership in New Zealand,* Malcolm Menzies identifies that a way of achieving higher productivity is to innovate, and that RS&T and entrepreneurship are two means (among others) of contributing to innovation. It might be assumed, from this, that these two separate factors – science and entrepreneurship – would make an even greater contribution if combined in some way.

Yet scientific entrepreneurship is a phenomenon that has not received a great deal of consideration either in New Zealand or internationally. Although science and entrepreneurship are both recognised as being important contributors to innovation, there is a prevalent mental model of these two sets of activities belonging to quite separate, albeit linked, realms and requiring distinct sets of competencies. This conventional model underpins a linear view of research and technology transfer into the commercial market.

Malcolm indicates that the linear model does not reflect the way science actually works, but policies and structures are still often based upon it, as with the design of the New Zealand science system. As a consequence, both creativity and the potential for scientific entrepreneurship can be suppressed. Moreover, it is increasingly recognised that it is tacit knowledge and other attributes that are of critical importance in the commercialisation of scientific research, and tacit knowledge can be transferred only through the movement of people who have it.

This implies a different metacompentency model of commercialisation wherein individual scientists take their ideas with them as they progress, through various stages, towards the market. In his concluding comments Malcolm notes that while the recent review of CRIs addresses some important barriers to effective research performance it perpetuates the 'outside in' approach of the orginal science system reforms, whereby structures were built with the expectation that the workforce would fit into them. Where scientific entrepreneurs are recognised, they need to be given the opportunities to lead and create teams rather than have those capabilities assembled by others. Ideally this requires the alternative 'inside out' approach to design of enabling organisations and processes.

Over the last two decades, the New Zealand government has sought to achieve improved outcomes in science and technology through structural reform, rather than increased levels of investment.

In his article, *New Zealand's bibliometric record in research and development: 1990–2008,* Shaun Hendy attempts to guage how successful structural reform has been as a strategy by looking at New Zealand's bibliometric output over the last two decades, using the Thompson Reuters Web of Science database. He notes that New Zealand's bibliometric output has undergone two periods of growth (1993–1998 and 2003–2008) in the last two decades. The first is associated with the creation of the CRIs and the establishment of the public good science fund. The second coincides with the introduction of the performance-based research fund in the tertiary education sector.

Shaun's analysis reveals that, while the output has shown some growth, bibliometric productivity has remained static. Changes in publication rate have been driven by increasing levels of full-time equivalent staff members, principally in the tertiary sector. Although the citation impact of university publications has increased, the citation impact of the CRIs has grown at a similar, if not faster, rate, suggesting that the performance-based research fund in the tertiary sector is not responsible for this increase. The widening gap in impact factor between the CRIs and the universities suggests an on-going diversification of research activity in New Zealand.

Finally in this issue we have two interesting papers on the continuity of the mind from the great apes to humans from Michael Corballis and David Penny

Previously in *Science Review* (66: 87–92), David Penny had urged biologists to stress more strongly the biological continuity between great apes and humans. Besides stressing genetic similarities, he suggested that great apes also share psychological capacities, including language and tool use.

In this issue, Michael Corballis argues that David underestimates the psychological differences and says, in *The giant leap to humankind,* that there is no evidence that great apes have anything approaching human language, or human technological capacity. A main ingredient of human cognition is recursion, which lifted communication to true combinatorial language and simple tool use to advanced combinatorial technology. He also suggests that recursion may also explain the combinatorial structure of human memory, imagination, and theory of mind. Part of the key, he maintains, may lie in the trajectory of human brain growth, but there is still much to understand in how micro-tweaking of the genome achieved such dramatic differences between ape and human.

In an invited reponse David Penny indicates that Michael Corballis has raised one of the most interesting and fundamental issues in modern science; is there anything about humans (es-

pecially in our mental abilities) that cannot be derived from our ape-ancestor by normal micro-evolutionary mechanisms?

He then gives a three-pronged analysis that revolves around: (1) the continuity of mind from young children to adults; (2) the similarity of measured mental abilities between young great apes and young children at similar stages of development; and (3) the observation that there appear to be no unique genes in the human genome for mental abilities (including for 'wisdom and intelligence'). The components that are required for language are then analysed, and important precursors found in the great apes. David's conclusion is that the best supported hypothesis, especially in a Bayesian framework, is for a continuum in mental states between an ancestral ape and modern humans.

I'm reliably informed that this dialogue is continuing with, I sincerely hope, outputs that will appear in future issues of the *Review.*

Editor