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Oz genomics - getting back on the bus

The platypus genome is causing ripples of excitement around the world. Published as a cover story in *Nature* this week, it is easily the most keenly awaited genome since the chimp. What can we learn from it? What practical use is this knowledge? Does it herald a new era in Australian genomics?

The excitement is because platypus is so different from the run–of–the mill placental mammals, having diverged about 210 million years ago. It is an amazing amalgam of reptile–like and mammal–like characters; a creature with fur that lays eggs but feeds its young with milk, and makes venom like a snake. It is often called the missing link between mammals and reptiles.

The genome truly reflects this biological mixture. There are genes that make egg–yolk proteins (though fewer than in a bird), and genes that make milk proteins (as many as a cow), and independently evolved genes that make toxins like snake venom. There are lots of surprises: for instance, sex is more like a bird than a mammal.

In genomics, difference is power. Power to find new genes (including human genes) and small signals that turn them on and off, by aligning sequence against placentals. Power to find out how complex regulatory systems like sex and epigenetic gene silencing evolved and how they work in humans. This knowledge is intensely sought to understand the biochemistry of life, and what happens when things go wrong, as in cancer cells.

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If difference is power in genomics, Australia should be very powerful. Being cut off from the evolutionary mainstream for 80 million years, Australia specializes in really different plants and animals. Our access to kangaroos and devils, dragons, kookaburras and (old) gumtrees presents opportunities to make unique contributions to international genomics.

So is the platypus sequence, the first for an Australian animal, a triumph for Australia? Alas, no. Sequencing was at Washington University, funded by the National Institutes of Health (NIH) of the US, and analysed by a huge international consortium. The project was not ours, although most platypus research is Australian, we generated the proposal, supplied the DNA, and helped interpret the sequence (25 of 100 authors are Australians).

In fact, Australia can claim only the humblest profile in international genomics. Of the 20 sequenced mammals published, we have contributed only a miniscule amount to the cow genome. The gum tree was sequenced in Japan. Australia had the chance to lead the project to sequence the first marsupial; we wrote the proposal to do the kangaroo. What happened? Despite intense urging, the Australian government refused to contribute even a tiny fraction of the funding. Result? The Brazilian opossum graced the cover of *Nature* last year.

Australia's support for genome science falls far behind many comparable countries. The Canadian Federal government invested a total of CA$840 million in Genome Canada over 10 years, funding half the research projects and technology platforms. Neighbours such as Singapore, Korea, China are investing heavily in genomics to generate significant scientific outcomes.

Does it matter that Australia contributes nothing to these milestone projects? The data all go up on the web anyway, so can't we sit on our backsides, then get it for free? No. We need to have an early seat at the international genomics table to enable us to be seriously involved in the next stages, the rush to utilise the avalanche of data to invent new diagnostic tools, new drugs, new approaches to agriculture.

So why did Australia miss the bus so ignominiously? Maybe Government and their advisors thought that we can get it all for free, and some senior scientists hoped this 'DNA stuff' would go away so we can all go back to old fashioned biochemistry. What a blunder! Genomics is fundamental to biochemistry, medicine, pharmaceuticals, agribusiness, forensics, ecology and wildlife management.

The one bright spot in Australian genomics is the kangaroo genome, now being sequenced by the Australian Genome Research Facility (AGRF). Funding came, not from the Australian Government or any of its grant schemes, but the State Government of Victoria, matched by the NIH, with funding also from AGRF. By far the largest genome sequencing project in Australia, this project salvages some national respectability and gives the Victorian Government a high profile in international biotechnology.

The next stages of genome science will see comparative sequencing accelerate to complete our picture of the fundamental plan of the genome and understand how it functions in different organisms. This is hugely important to biotechnology, and Australian scientists are poised to make big contributions. The National Collaborative Research Infrastructure Strategy recently granted initial support for some infrastructure and operating costs for genomics over the next four years.

This potential was evident at the recent 10th Anniversary Symposium held by the AGRF in Melbourne, in April, as scientists talked about the genome of yeasts vital to producing quality wine, about genes that are mutated in children with epilepsy, genes that tell plants when to flower, and genes that can make plants into better biofuels.

Can we still get back on the bus? We must if we are serious about being major, or even minor players in biotechnology. There are great opportunities with the new generation of sequencing technology to use it inventively, capitalising on our unique resources.