DNA dollar dazzlers

Money is the key to coaxing the genie out of the bottle for Australian genetics, writes David Binning.

Mapping the human genome, while one of the great moments of science, marked a sad chapter for Australian geneticists – for all our skills and proud history, we simply didn't have the sort of money needed to sit at the table.

Now, leading researchers are concerned that if more isn't done to redress the current genomics funding shortfall, Australia could forfeit not just scientific kudos, but valuable export dollars in the future as other countries harness new genetic techniques for competitive advantage.

"In terms of very large projects of the scale that is occurring overseas we're not in that game because the pools of money are not there," says Assoc Prof Philip Batterham, chairman of the Australian Genome Alliance.

The AGA convened last February to discuss various issues surrounding Australian genetics, including the need to establish a dedicated fund that would assist the best programs to get off the ground. Citing the example of Genome Canada, it argued that Australia should aim for an equivalent fund of around AUD$800 million. Realistically, however, Batterham feels $150 million would be a good start.

Such financial support would, he says, ensure that situations such as occurred with the human genome are not repeated. Batterham cites the Cattle Genome Project, which has several members including the US, UK, Canada and New Zealand, as an example of where Australia was able to buy control early in the piece. "We've been a voice at that table from the beginning".

One of the key future projects he thinks Australia should be looking towards is that to map the genome of the cotton bollworm. Otherwise known as *Helicoverpa amigera*, this moth affects over 100 different crop species at an annual cost of about US$5 billion.

Naturally, though, a genome project would be vastly expensive and without something like a Genome Australia fund it is more likely another country will act first and derive the anticipated economic benefits.

"There is no funding agency in Australia capable of funding a project on the scale we are talking about," Batterham says.

Bringing the problem into even sharper focus, he says, is the fact Japan and Brazil each have well-advanced projects studying the genome of eucalyptus trees and that this should provide an early warning of the economic dangers of allowing our own "biota" to fall into foreign hands.

"We talk about biotech space where the unique thing we have is our biota – to hand over control just by neglect is just shameful. The reality is that anyone can get enough tissue for DNA and really start working on a genome and developing and commercialising the outputs," Batterham says.

WALLABY WORK

By far the largest genome project involving Australian scientists is that to map the genome of the Tammar wallaby. Head of the project, director of the Australian Genome Research Facility's (AGRF) Dr Susan Forrest, says that by December this year she expects around 75 per cent of the wallaby's genome to be sequenced. One eventual outcome will be imparting the secrets of its unique milk to the dairy industry.

"Wallabies produce milk of different content depending on the stage of the animal... [and] the dairy industry is really keen to understand milk content," Forrest says.

Work on this particular genome is anticipated to yield further important results for human biology given its 68 per cent similarity with the human genome. But while obviously a major boon for Australian genetics, the fact that our largest genome project is jointly funded by America's National Institutes of Health (NIH) highlights a lack of local wherewithal to independently fund and manage projects on any meaningful scale.

"Unless we can either read the gene sequence or understand the genetic processes that underlie all these interesting areas that we've discovered we're not going to be able to capitalise on them in any way," Forrest says.

Prof Richard Cotton, of St Vincent's Hospital in Melbourne and the University of Melbourne's Genetic Disorders Research Centre, has been directly involved in creating the world's first mutations database in conjunction with the World Health Organisation. Given that some form of mutation affects over 60 per cent of the world's population, Cotton says Australia has an opportunity to play a major role in this emerging area of genetics.

However, his plans are somewhat financially ambitious. "What we'd ideally like is curation of every gene. full stop." Such an undertaking would require around $240 million; a lot of money, especially in Australia, although funding such a program would, in Cotton's view, yield huge benefits. "It would raise the international profile and kudos of people working in genetics in Australia."

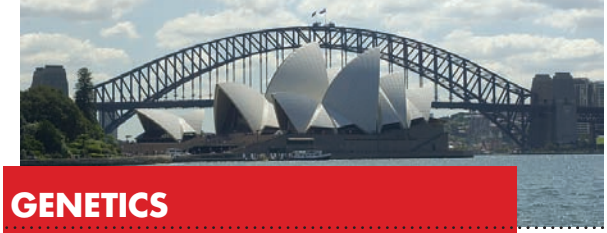
GENE STARS

Of course there are already several internationally renowned Australian companies and individuals working in the field that continue to hold the mantle for those hoping to follow in their footsteps.

Melbourne-based company Genetic Technologies, for instance, discovered applications for non-coding, or 'junk' DNA that have seen the business earn more than $50 million in licensing revenues via its 29 worldwide patents. GTG has also had some success in marketing a genetic test to nurture elite athletes and last month partnered with US-based MetaMorphix to develop genetic testing and verification of breed in dogs and other animals including livestock.

Another star, Bionomics, identified the first gene associated with epilepsy. In 2004 the company created the first genetic test for the severe myoclonic epilepsy of infancy (SMEI), which can have a devastating impact on children but which has lacked effective diagnosis methods.

Bionomics' managing director Dr Deborah Rathjen says that



there could certainly be more funding for Australian genetics given its many notable achievements.

"The level of expertise in Australia is actually quite high and the amount of genetic research in Australia – within specialist areas – is actually quite competitive," she says.

Overall, however, AGRF's Forrest says Australian genetic research is "significant in pockets but not internationally recognised as well as it could be."

"It's a growing trend amongst the genome sciences in Australia to say 'Why isn't there more recognition?'"

Most agree that the main reason for this is the lack of larger scale projects. While obviously something of a Catch-22 for the moment, it is hoped that more money from government and other sources will bring about the necessary change.

"If we have a situation where more than one group puts its hand in its back pocket it [genetics] would have mileage in Australia," Forrest says.

GOING THE GAMUT

Also key to a better future is the eventual coming together of the various groups, projects and individuals involved in genetics in Australia.

"Fragmentation is a lot of the problem," Forrest adds. "It's a discipline that crosses so many boundaries."

No organisation highlights this fact more than the CSIRO, which has developed several world-leading genetic technologies across its many divisions, including RNAi gene silencing.

CSIRO group executive for agricultural business, Alistair Robertson, says that genetics, and more generally transformational biology (including proteomics), is at the core of the group's efforts to branch out beyond agricultural industries and develop commercially relevant products spanning preventative medicine and industrial commodities.

For instance, the CSIRO's Food Futures Flagship is researching the genome of plants that produce Omega 3 fatty acids. Omega 3, of which most people consume just 10 per cent of their needs, is slowly creeping into wheat products thanks to CSIRO.

"It's an example of how we're using modern biology in driving new plant materials for beneficial outputs," Robertson says.

Another interesting CSIRO project involves studying the recombinant resilin proteins, which give fleas such disproportionate strength, and applying them to insoluble materials for products such as heart valves and injectables for drug delivery.

In emphasising the huge role genetics is expected to play not only in medical science but across the whole gamut of commercial industry and beyond, the AGA's Batterham says that while Australia does need to invest more in its people and raw infrastructure, when it comes to the field of genetics, the DNA sequence needs to be viewed as a form of infrastructure in itself that needs to be nurtured, protected, and of course, invested in.

"It's just not so easy to put a plaque on [a genome sequence] during an opening ceremony." ■