



A bank designed to profit all

A pocket of middle Australia on the northern outskirts of Perth is the setting for a proposed biobanking project that even its instigator, Professor Lyle Palmer of the University of Western Australia, calls "ludicrously ambitious". Fiona Wylie reports.

OVER THREE YEARS in the planning and involving many partners and stakeholders in Western Australia, the planned Joondalup Family Health Study will be the focus of Lyle Palmer's plenary presentation at the upcoming HGSA conference in Adelaide, titled *Biobanks: next steps in complex disease discovery*.

The Joondalup Family Health Study (JFHS) is planned to be a modern version of the highly successful and acclaimed Busselton Health Study, one of the longest running epidemiological research programs in the world. Started in 1966 and based in a town in WA's south-west, Busselton has improved the health outcomes of many patients suffering chronic diseases such as asthma and cardiovascular disease.

Much has progressed in the field of genetics and genomics since ALS last spoke to Palmer, chair of genetic epidemiology at the University of WA, about his plans for a WA biobank project. "Since 2006, we as a genetics community have worked out how to find genes for complex disease," he says.

Publication of the first really large genome-wide association studies in early 2007 gave the proof of principle. These showed that with a big enough study and enough markers across the genome – half a million or more – common genes associated with modest effect sizes could be found for diseases such as rheumatoid arthritis, cancer, heart disease and diabetes.

Given the field's vastly improved understanding of the architecture of the human genome in recent years, the discovery of common genetic variants in human disease was not a surprise *per se*, according to Palmer. However, the speed

and scale of the findings shocked almost everyone.

"It is probably more explosive and spectacular than we ever thought it would be in terms of success," he says. "There are now well over 100 validated, new genes associated with complex human diseases and the figure is rapidly heading towards 200. It has been described repeatedly as the most explosive period of growth in biological knowledge in history – sort of like doing physics 100 years ago."

Australia's chance to shine

Of course, gene discovery raises further questions, particularly of function and mechanism. For instance, how, what and when are all these genes and gene variants acting biologically and what does it mean for protein, cell and tissue function? In this context, Palmer's main interest is working out how he, and indeed Australia, can best capitalise on this wealth of new genetic knowledge for positive health outcomes.

"We know all this great stuff we didn't two years ago. Suddenly, we have 11 known genes for type II diabetes that together explain about 60 per cent of the risk, and five common genes for prostate cancer that together with family history explain around 40 per cent of the population risk.

"The question really is how to use this sort of knowledge to directly impact clinical practice and public health. What we are focusing on and where I think Australia has the most to offer the world is in public health genomics, genomic medicine and the translational applications of new genomic knowledge."

The translational medicine aspect is the focus for Palmer and colleagues in building on and extending the long-established



epidemiological research in WA. Biobanks – biobanking is the collection and analysis of population databases – have certainly experienced a huge push worldwide in the last few years. About 118 biobank projects that involve more than 10,000 people are currently running globally, and it is not easy to find a country in the world not running or planning one.

Based on early efforts in some countries, the worldwide focus now is on collecting very large sample sizes of DNA and preferably other biological material together with as much phenotypic information as possible on large, population-based samples.

“This focus has really changed fundamentally how governments, industry and researchers are thinking about doing large-scale epidemiology,” Palmer says.

“We all realised that we really need to study hundreds of thousands of people and set ourselves up to characterise these new disease-associated genes if we are to translate the results for clinical benefit. We need to work out what these genes are doing in a general population and how they interact with other genes and with environmental

<< *Continued from p14*

factors such as smoking, diet and physical activity to increase risk of disease.”

The next step is to set up a population-based platform to enable translational research, including new clinical trials with recruitment based on genotype. For instance, how do population and clinical researchers use the known genes for diabetes for health benefits in a general practice setting? “It is a mission involving education, software production, and standardising of genetic data and family history collection by general practitioners and health workers,” he says.

Wealth of the west

So why Western Australia? With home-state knowledge, Palmer knew that WA had distinct and significant advantages for the type and scale of genetic epidemiology he wanted to do after returning to Australia from similar work as a junior professor at Harvard Medical School in the US. Australia in general has well established and widely recognised expertise and facilities in population-based research and clinical research. It also has a proven ability to translate the data into clinical benefit, and some of the best examples of this ability come from WA.

One reason for this history is the condensed nature and cohesiveness of the state health system. There is a limited number of referral centres for the whole population, which facilitates complete population base ascertainment of whatever it is being studied study – “a really big advantage,” according to Palmer. WA also has a long history of population-based research, including the Busselton study.

“We have over 40 years of linked data and linked families within that. No other state in Australia and only five other countries in the world have anything like the amount of information we have here.” Palmer credits Busselton as a great inspiration that helped set the scene for the planned Joondalup project. “For one thing, Busselton was seen as a great thing by the Western Australian community. People have been following it for 40 years so this type of study and its benefits are already in the general consciousness.”

On a more local level, Joondalup is a





relatively new and geographically distinct city with a very strong sense of identity. Joondalup also houses two university campuses and one major hospital, so already has a huge amount of the necessary infrastructure in place as well as relevant government, educational and medical facilities. Most importantly perhaps, the people of Joondalup are incredibly and overwhelmingly supportive of the

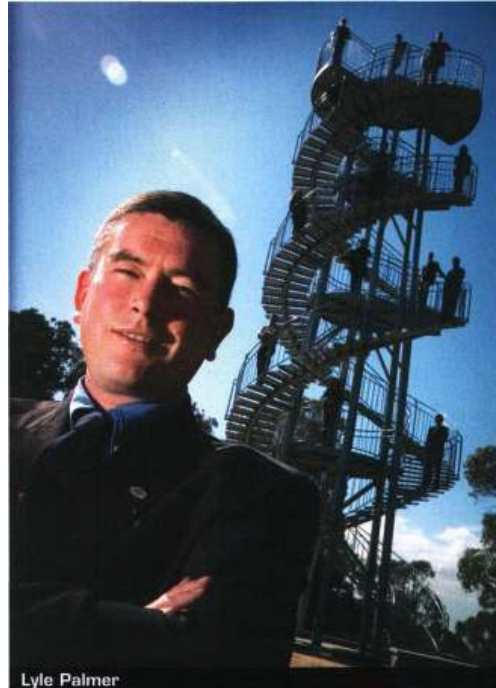
whole project. Basically, "if we can't do it successfully here, it probably can't be done anywhere," Palmer says.

No body part left unturned

Palmer concedes that a population health study of 80,000 people isn't huge by world standards, placing it around the middle of biobanks worldwide. The reason that Joondalup has attracted so much attention in the international biobanking arena is because of the density of data being collected. Palmer describes the planned study as being "the most fully characterised human cohort resource of all the biobanks being planned or constructed. Basically we hope to have nearly every senior medical researcher in WA involved measuring every bit of relevant individual health data we can think of."

Another important point about the WA biobank is its place in the global scheme, and organisations such as the P3G consortium (Public Population Program in Genomics) are key to this. P3G is currently the peak global biobanking body and Palmer sits on its board.

"P3G has made enormous progress in harmonising questionnaires and testing for biobank participants, and in standardis-



Lyle Palmer

ing aspects such as DNA collection," he says. This means that data ultimately collected in the Joondalup Family Health Study will be directly comparable across biobanks globally.

"Researchers have come to realise that even a resource such as UK Biobank, which is collecting data from half a million people, will not have sufficient resolution to look at many less common diseases such as lung cancer. The only way that we can make these resources useful for diseases that are common, but not as common as type II diabetes, is to enable them to be used collaboratively." It seems that everybody has realised this is the only way that progress can be made, with even some of the large global pharmaceutical companies like GlaxoSmithKline putting their genetic data on-line.

Palmer also highlighted that several additional and far-reaching benefits of what they are doing in WA are already emerging. "All of the infrastructure built with the Joondalup Family Health Study in mind with the help of series of enabling grants from NHMRC are also enabling and underpinning a huge amount of work going on elsewhere in Australia."

Facilities such as the National Training Facility in Medical Informatics (AMBeR), the WA DNA Bank and the WA Genetic Epidemiology Resource are increasingly supporting other major initiatives such as the Australian Twin Register based in Melbourne, the Australasian Sleep Trials Networks, the Trans-Tasman Radiation Oncology Group, and the national networks for mesothelioma (GUARD) and brain cancer (AGOG).

"Australia is a small country with limited resources to put into research, but we have to be smart about our investment and go for things that we can be world class at, and this is one of those things," Palmer says. "It is certainly pretty cool stuff and everyone is watching this space." **ALS**