

# Diabetes Breakthroughs

Over the past 40 years, we are thrilled to have contributed to some extraordinary research findings helping advance the understanding of diabetes and ways to better manage or treat it, including the following highlights.



**1.** The international discovery of more than 50 genes causing type 1 diabetes – an enormous leap forward for understanding the genetic pathways of diabetes and for creating better treatments to prevent or cure it.

**2.** Finding that while most of the known type 1 diabetes genes showed a significant effect in Australian families, many appeared to have no effect, suggesting there are environmental interactions with these genes that cause the condition, and that these environmental factors differ between Australia and the UK/USA.



**3.** Research showing type 2 diabetes can dramatically affect the everyday thinking skills of up to 1 in 3 adults aged 60 and older. Brain-related changes linked to type 2 diabetes can lead to problems such as memory difficulty, poor attention, and slower speed of thought.

**4.** The development of the field of Systems Genetics which goes beyond using single genes and instead looks at how each gene can have an effect on whole networks of genes and whole systems. It has been used to test 53 known type 1 diabetes genes and showed only 11 genes could cause a change in proteins, while 25 controlled the expression of nearby genes and 17 controlled the expression of distant genes. This data could open up new pathways for treating type 1.





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Diabetes is the nation's fastest growing chronic disease with, on average, 280 new people diagnosed with it every day – enough to fill the MCG every year.



**5.** Identifying how to produce pancreatic insulin-secreting beta cells from precursor cells. The ultimate hope is being able to trial the breakthrough in humans with a view to provide new, more permanent treatments or a cure for type 1 diabetes.

**6.** Finding that women with childhood-onset type 1 diabetes have a mortality rate before the age of 40 that is 11 times higher than the general population. Key risk factors for these women include poor long-term control of blood sugar levels, low socio-economic status, and four or more episodes of dangerously low blood glucose levels during their childhood years. This information may help to turn around the situation by identifying those women who need closer care while still young.



**7.** The discovery of a way to genetic information to predict – at the time a person is diagnosed and years before symptoms develop – the risk of them going on to develop diabetes complications. This knowledge could be used to better care for people with diabetes, prevent complications and significantly reduce health care costs.

**8.** Discovering in a study of WA children diagnosed with type 1 diabetes, that they are more than twice as likely to be affected by mental health disorders, such as anxiety, eating, and personality and behaviour disorders, during early adulthood than their peers, knowledge that could help prevent such issues.





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MRI brain scans may be able to help predict which people with type 2 diabetes are more at risk of developing dementia.



**9.** The creation of the next-generation genetic resource, The Gene Mine, which is being used globally to help with rapid mapping and identification of genes. For example, Melbourne collaborators found genes that control body weight and type 2 diabetes susceptibility.

**10.** Defining a genetic signature of a high-risk group of people who are likely to develop type 1 diabetes within four years of having auto-antibodies. This breakthrough could allow more powerful and more economical clinical trials to test treatments to prevent type 1.



**11.** Showing that lupin-supplemented diets have beneficial effects in protecting against type 2 diabetes-related traits such as blood levels of the obesity hormone, leptin. Lupin dietary intervention significantly decreased leptin levels. Knowing lupin-based diets may improve general health by reducing obesity in some people could help keep type 2 diabetes rates down. The research also found the lupin diet can significantly reduce insulin resistance, a precursor to type 2 diabetes.



**12.** Finding that MRI brain scans may be able to help predict which people with type 2 diabetes are more at risk of developing dementia, opening up new possibilities for being able to prevent or delay it.





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1.25 million Australians already live with some form of diabetes.

On top of that, it's estimated another 500,000 Australians have type 2 diabetes but don't yet know it.



**14.** The creation of a world-first model of diabetic retinopathy, which it's hoped can be used to find protective genes to develop preventative therapies and diagnostic tests to identify people most at risk.



**16.** Confirming the protein SLIRP plays a role in energy metabolism, possibly due to its effect on the activity and expression of the protein Egr1 – a transcription factor known to modulate insulin sensitivity. The ultimate hope is to find ways to 'silence' SLIRP to normalise blood sugar levels in people with diabetes and, in doing so, prevent diabetic complications.

**13.** Establishing the Australian Childhood Diabetes DNA Repository which recruited more than 3000 families affected by type 1 or young-onset type 2 diabetes. Several studies have been conducted using this genetic information, identifying many diabetes-related genes. The resource is available to Australian researchers so has the potential to provide many more advances.



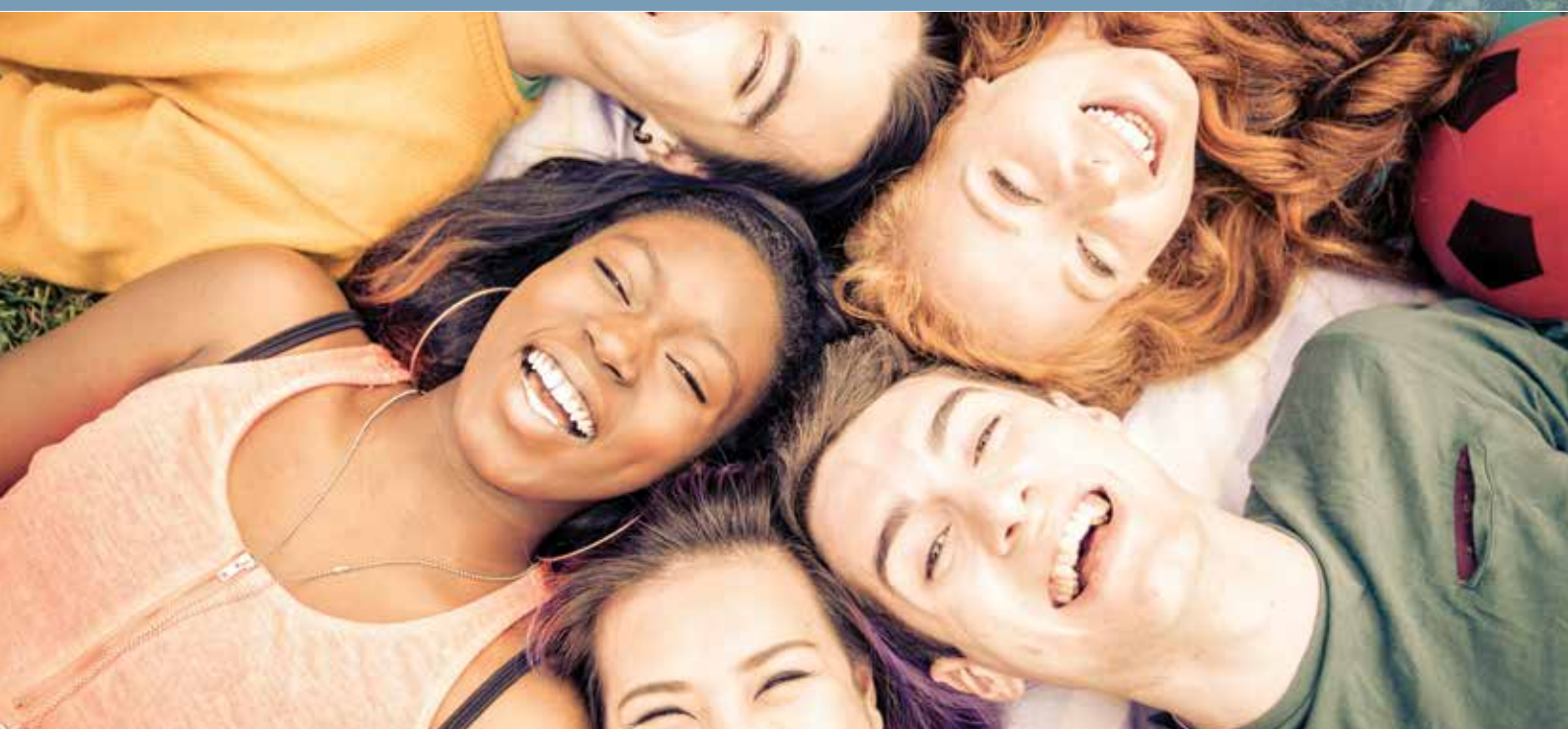
**15.** Using bone marrow transplantation experiments, successfully demonstrating that haematopoietic cells (cells within the bone marrow that produce cells that circulate in the blood) are a major source of the TNFSF14 protein that protects against diet-induced obesity. This work may give rise to new treatments for type 2 diabetes as none of the commonly used anti-obesity drugs have resulted in consistent and effective weight loss.





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**17.** Helping validate a model to predict teenagers with type 1 diabetes who are at greatest risk of early kidney problems, therefore being able to potentially reduce this risk.

**18.** Finding the use of a dedicated health expert could support children transitioning from child-based health care to adult health care settings. Participants were more likely to have kept appointments during the study and were less likely to have diabetes-related emergency department visits compared to the control group.



**19.** Discovering 6 subtypes or 'signatures' of type 1 diabetes and 3 type 2 diabetes subtypes, paving the way for helping prevent diabetes complications.



**20.** In a WA study, finding that for people with type 1 diabetes, the incidence rate during early adulthood of end stage renal disease (kidney failure) was 12 times higher than the general population and the rate of stroke was seven times higher. It was also observed that retinopathy (diabetic eye disease) is notably more

prevalent among females, and poor long-term control of blood sugar levels remains a powerful predictor for those at high risk of developing this comorbidity. These findings can be used to help introduce better care in a bid to avoid these complications.