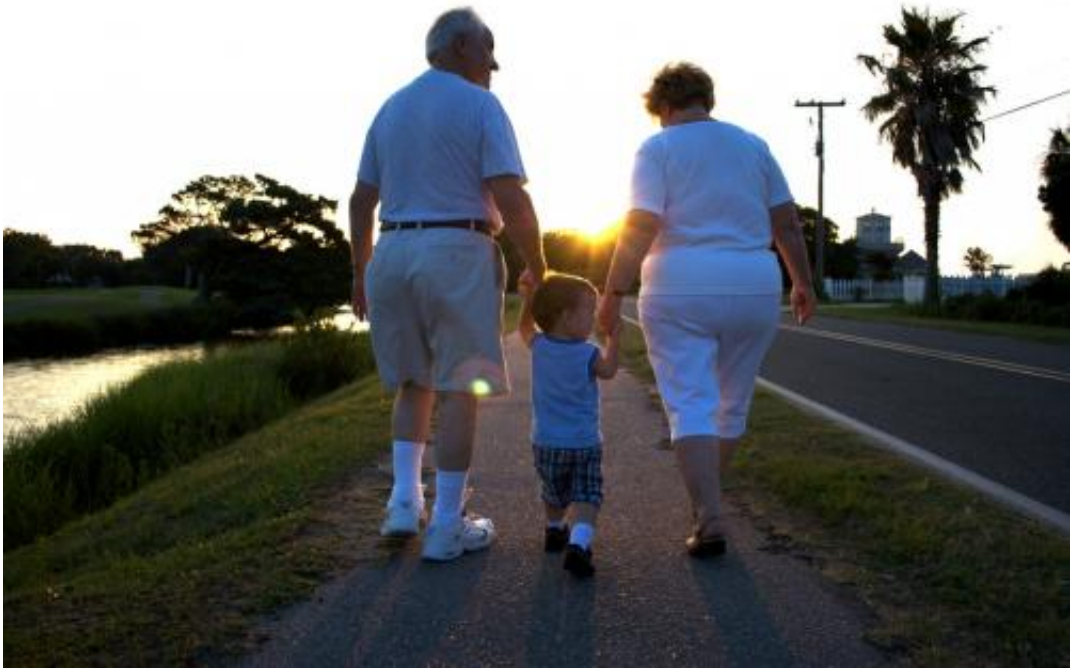
Babies with Down syndrome could help delay the onset of Alzheimer's disease

July 3 2014, by Annette Karmiloff-Smith



The future's bright. Credit: spabis, CC BY-NC-ND

Alzheimer's disease is typically a disease of later life, and age is the biggest known risk factor for the condition. But babies with Down syndrome, who always develop brains like those with Alzheimer's later in life, don't always go on to develop dementia. A study that I am involved in, called LonDowNs, is now trying to find out why this may be, with the hope of finding ways to slow down the development of

dementia.

The global economic cost of Alzheimer's is estimated to be US$1 trillion per year by 2050. Delaying the onset of the disease by only six years could reduce those affected and save more than $400 billion.

Alzheimer's disease causes memory loss, mood changes and problems with communicating and reasoning. Apart from age, other factors can increase the risk of an individual developing the condition. Some of these are lifestyle-related, such as smoking, diabetes or high blood pressure. Others are based in our biology.

My research group is studying babies with Down syndrome – a genetic disease that causes delayed physical growth – to find out more about the changes that occur in the brain during the development of Alzheimer's disease. Babies' brains can, it turns out, tell us quite a lot about adult brains.

Those with Down syndrome have an increased risk of developing Alzheimer's disease. Among those aged between 50 and 59 years, one in three suffer from dementia (the most common form of which is the Alzheimer's disease), if they also have Down syndrome. That proportion rises to one in two for those over 60 year of age.

The increased risk may have something to do with why Down syndrome occurs. Every one has two copies of 23 chromosomes, which make up all the genetic information in any human cell. Those with Down syndrome have three copies of chromosome 21, and the genetic code in this chromosome produces a protein, called amyloid-beta precursor protein (APP), which is implicated in Alzheimer's disease.

By the age of 30 the brains of all individuals with Down syndrome show a high number of "plaques", formed from a group of mangled APP

molecules. Unlike in the general population, this process has been shown to start in infancy in those with Down syndrome.

What is interesting, however, is that, while all individuals with Down syndrome will ultimately develop the typical Alzheimer's brain pathology, not all of them get the disease in adulthood. Something is protecting some of them from developing dementia.

To find out what that protecting factor is, we need to study people with Down syndrome across all ages and understand the environmental, genetic and biological factors that affect them. We have now started working on doing that by first creating Down syndrome and Alzheimer's disease in mice. The results from this will help us shape how we study infants and adults.

We have recruited children between six months and five years of age. We will perform behavioural assessments through observation of the child with their parent or caregiver. For instance, some of these will involve eye tracking and assessments of memory and attention while the infant watches videos on a screen.

The hope is that, by identifying risk factors for dementia during very early development, we may be able to help target preventative treatments for individuals with Down syndrome and subsequently the general population. It may lead to treatments that could slow down the cognitive decline seen in Alzheimer's disease, or even reverse it.

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