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# Telomeres – the invisible elixir of youth

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Since antiquity, society has obsessed over the visible signs of growing old – wrinkles, grey hair and saggy skin. But there's another kind of ageing worth your attention because scientists are starting to to learn how to reverse it.

This week, a group of international researchers, including Nobel prize-winning Australian molecular biologist Elizabeth Blackburn, announced that a healthy lifestyle, comprising regular sleep, exercise and a balanced diet, could offset ageing inside the body's cells.

Key to youthful cells are special molecules of DNA called telomeres, which are protective caps that stop the coils of genetic information that instruct almost every cell in the body from fraying.

Blackburn, who shared her 2009 Nobel prize with two colleagues, discovered that without telomeres, cells could not divide and the body could not grow. Essential to the telomeres function is a special enzyme called telomerase, which replenishes the DNA caps as cells divide.

But the body has only a limited supply of telomerase, which restricts cells' ability to replenish their telomeres. As a normal part of ageing, these protective sheaths shorten until they become so stumpy they can no longer protect the genetic code and the cell programs its own death.

"When the connection between telomeres and cellular ageing was discovered, it was quite exciting," says telomere biologist Tony Cesare, from the Children's Medical Research Institute in Sydney.

Like many big advances in medical research, its initial applications – some suggested a miracle elixir of youth – were over-egged.

Once the hype dissipated, scientists identified the deterioration of telomeres as a crucial part in many age-related illnesses such as cardiovascular and Alzheimer's diseases, Cesare says. In mice, premature ageing could be reversed by reactivating telomerase.

More recently, researchers have also pinpointed several factors that can accelerate telomere shortening – faulty genes and chronic stress. A growing body of evidence also suggests a poor lifestyle contributes to telomere decline.

Blackburn's latest study with Eli Puterman from the University of California found women who slept well, exercised and ate a balanced diet appeared to be protected from stress-induced telomere shortening.

Cesare says while some scientists were initially sceptical of the role of lifestyle on telomere ageing, evidence was mounting that healthy choices contributed to healthy cells, and that this may offset the impact chronic stress can have on telomere degradation.

Children who endure a disadvantaged upbringing, and women who care for a chronically ill family member or have been victims of domestic violence, have shorter telomeres than those who have not experienced these kinds of stressful events.

It is thought stress ages the body's immune system by speeding up the shortening of immune cell telomeres, which makes a person more vulnerable to disease.

While telomere length is an easy marker to measure the telomere health, Cesare says scientists are yet to undercover the exact mechanisms by which shortening could prompt cell death.

He also says there are people with genetic mutations that cause their telomeres to be very short who often develop diseases of ageing in their youth.

While the body's limited supply of telomerase in normal cells is the basis of ageing, an oversupply of this enzyme is one of the ways cancer cells divide and multiply.

"In the hands of the wrong cells [telomerase] is a really dangerous weapon," Blackburn says.

Since this discovery, researchers have doggedly searched for a molecule or drug that can inhibit telomere preservation in tumour cells as a potential cancer treatment.

"We're going to keep at it until someone can solve this problem," Cesare says.