

Why fitness slows ageing

SCIENCE NOW BELIEVES WE CAN SLOW AND EVEN REVERSE AGEING. ONE OF THE MAIN WEAPONS IS EXERCISE, WHICH HAS BEEN SHOWN TO DIRECTLY IMPACT ON THE LIFESPAN OF OUR CELLS. TONY SARNO REPORTS.

Until recently ageing was considered inevitable. Those first, tiny crows feet in the corner of your eyes in your late 20s, the slight drop in VO2 max as you hit 30, that receding hairline in your mid-30s, the creeping shortsightedness at 45 and those unavoidable jowls at 50 are familiar symptoms of an ageing process none of us believe we can do anything about. Despite the claims of the cosmetic anti-ageing industry, with its miracle anti-wrinkle creams, dermal fillers and laser resurfacing, no one seriously thinks they won't eventually follow their parents and grandparents into senescence and that big gym in the sky.

But this universal view of ageing and death as inevitable is changing. A series of groundbreaking studies into the molecular and genetic processes behind ageing and a bunch of middle-aged billionaires who are worrying about their mortality and pouring millions into anti-ageing research are now changing the rules.

Many biologists, gerontologists, geneticists and medical professionals are convinced that ageing is simply a disease that begins subtly in our 20s, one that

eventually breaks down the machinery that powers us, and which brings us to a halt at 79 years of age, on average, in Australia. They believe that if we better understand how ageing happens we can also figure out how to stop it. In fact the very complexity of ageing is what gives them hope, because it presents many targets that anti-ageing science can attack.

Professor Merlin Christopher Thomas, a physician and scientist from Baker IDI Heart and Diabetes Institute in Melbourne, who has written a book on slowing ageing, says "ageing is not simply a matter of time. It is not even a wholly biological experience, but a complex change determined by environmental, behavioural, cultural, socioeconomic, psychological as well as biological factors. This is why different people can age at different rates. It also explains why it is really possible to slow ageing."

WHY WE AGE

The main reason we age is that over time we suffer a host of biological system failures deep inside our cells. In very simple terms, ageing is a breakdown of the machinery that fixes the oxidative damage caused by the damaging products of energy production in our cells. Free radicals cause damage from the day you're born, but they are efficiently cleaned up until later in life. As our defenses become less effective over time, the more damage gets through.

But the speed at which we age is also influenced by our lifestyle choices, such as how much we eat, how much fat we carry, how much we drink, what stress we're under and how much we exercise. The last is proving to be more important than anyone expected.

HOW BEING FIT SLOWS AGEING

Maintaining the telomeres

We've always assumed that exercise must slow ageing. But a series of recent studies, including one from Australia, have provided direct proof. Most astonishing of all, this proof shows that being fit – alongside reduced calorie intake – is the most effective thing you can do to slow the ageing process outside of taking some yet-to-be-invented wonder drug produced in a lab. That's because the impact of exercise goes to the very heart of one of the body's main ageing mechanisms, the length of your telomeres.

In each of our cells is our genetic fingerprint, the DNA that takes the form of those twisted, double-stranded structures that are organised into X-shaped chromosomes. Each time a new cell divides, the chromosomes inside it have to copy themselves for the new cell. At the end of each chromosome is a little tie called a telomere which prevents the chromosome from fraying or accidentally losing DNA when it duplicates, and which has been compared to the plastic tips of shoelaces. But the problem with telomeres is that each time a chromosome duplicates, the telomere gets shorter. When it gets too short to do its job the chromosomes (like shoelaces with a missing plastic tip) start to fray and the cell can no longer replicate successfully, and either dies or develops into cancer.

The kicker is that recent studies have shown that exercise slows down the rates at which telomeres

shorten. Even more surprising, exercise can make them longer again. Research led by Professor Fadi Charchar from the School of Health Sciences, at the Federation University Australia (a collaboration between Monash University and the University of Ballarat), recently proved this.

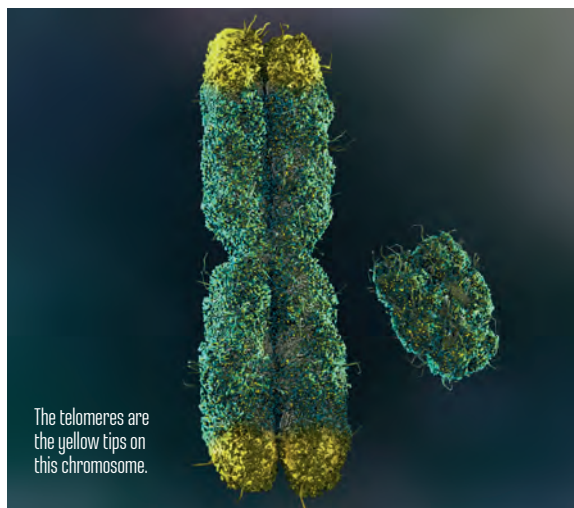
Prof. Charchar and his PhD students looked at the impact of ultra-marathon running on telomeres of several runners. What they found was that long distance running can halt the ageing process and increase the lifespan in some individuals by as much as 16 years.

"We found that doing running – and lots of running – can do wonders for telomeres," Prof. Charchar said. The research found that ultra-marathon runners running 40km to 100km a week had 11 percent longer telomeres than those who didn't. Now, if you're thinking you won't be running 40km a week anytime soon, these results matched those of several other studies which found the same effects on telomeres by different kinds of much milder exercise.

In the most recent and widely quoted study published in *The Lancet Oncology* journal, a group of 10 men participated in a five-year trial in which they made drastic changes to their lifestyle that included 30 minutes of exercise a day, dietary changes and stress management. Their telomere length increased by 10 percent but in the men who stuck to a more sedentary lifestyle telomeres shrunk by 3 percent over the same period. Another famous study, by researchers at the University of Colorado, compared telomere length between two groups of people between 55 and 72 (sedentary and active) and found that the group which had exercised most of its life had significantly longer telomeres than the sedentary group.

All this research validates an even earlier study, from 2008, when 2,401 people were tested by a professor of genetic epidemiology at King's College, London. Subjects who did about 100 minutes of exercise a week tended to have the telomere length of people five to six years younger. Most impressive of all, people who exercised more than three hours a week had telomeres nearly 10 years younger than those who did the least amount of exercise.

So the evidence is pretty clear. Exercise increases



telomere length, which we know correlates to lifespan. But how does it do it? We asked Prof. Charchar.

"We don't yet understand the exact mechanisms in the cell that lead to these improvements," he told *Fitness First* magazine.

"Our other study shows that exercising may enhance the level of the TERT gene, which is an enzyme in the cell that helps maintain and increase telomeres. There are other theories floating around that include the fact that the more you exercise the more long lasting the effect on the way genes behave, and you may even pass this on to your offspring, which is even more fascinating."

Prof. Charchar's research said the 11 percent improvement in telomere length detected in the runners in his study would add about 16 years to life expectancy. "This is called biological age and it's worked out based on average telomere length in thousands of people. So we can work out how many DNA base pairs are lost as you age and work out an average estimate based on this."

Prof. Charchar is planning more research to find out the exact amount of exercise needed to see an improvement in telomere length. "What are the mechanisms involved? Are improvements in

The Billionaires

Anti-ageing scientists are excited about Google joining the anti-ageing war. Google has classified its new project to fight ageing as a "moonshot," likening it to its driverless car project. Google's founder and CEO Larry Page – who's now in his 40s – has set up a company called Calico that he believes will make significant breakthroughs in increasing the average lifespan within the next 10 to 20 years, aided by Google's millions. While the anti-ageing community is excited that Google may finally pour serious funds into longevity research, the sceptics say Calico may also give Google a legitimate reason to map everyone's genome (just as it maps the world's streets) and then perhaps serve us internet ads based on our genetic makeup.

But, hey, who's complaining if Google can make us live forever?

Other billionaires are supporting anti-ageing research too. Larry Ellison, the head of a database company, has handed \$445 million to his medical foundation to research age-related diseases. Then there's the Russian billionaires such as Dmitry Itskov, who is spending his millions on a project to create an immortal Avatar body. There's a thread here: these rich guys are getting their mid-life crises and are prepared to invest their millions to live longer. We could all benefit.

Larry Page believes anti-ageing research will enable us to increase our lifespan

cellular make up passed on to offspring?" he asks.

Look After Your Mitochondria

But slowing shortening of telomeres is not all exercise does to fight ageing. It impacts at the cellular level in yet another, powerful way. Several studies have shown that exercise benefits mitochondrial function. Mitochondria are energy producing factories in cells which have their own DNA that's separate from the one in their host cell. A bit like the shortening of telomeres, changes in mitochondria are one of the major causes of ageing and their function is strongly correlated to lifespan, so much so that some scientists think the mitochondria's ageing is the main reason we age.

Over time, as repair mechanisms in the host cell deteriorate, mitochondria start to accumulate damage and generate less energy. Since the mitochondria are the power plants of our cells, their decline is also a death sentence for their host cells and, eventually, us.

But exercise has been shown to increase mitochondrial biogenesis (which forms new mitochondria in the cell), slowing age-related decline. In one celebrated study, researchers from McMaster University in Ontario, Canada engineered some mice with malfunctioning mitochondria. Within three months all the mice were showing the signs of old age, but half were then exercised three times a week in 45 minute sessions on the spinning wheel. At eight months, when their sedentary lab mates had become bald, frail and were dying, the running rats remained youthful and retained almost all of their muscle mass and general functioning.

Another study looked at the effects of exercise on mitochondrial function and muscle mass of a bunch of men in their late 60s. The participants exercised for 30 minutes up to six times a week over 12 weeks. The participants showed a massive increase in mitochondrial content, of around 53 percent.

Build Muscle Mass

We all know exercise also improves muscle mass. And while it's nice to look ripped, the anti-ageing benefit of muscle mass is that it helps keep body fat under control, thus dampening chronic low-level inflammation in the body in-check and boosting metabolism and the immune system. As covered in our article on inflammation on page 30, chronic low-level inflammation is a major cause of disease.

Start Now

In his book *Fast Living Slow Ageing*, anti-ageing expert Merlin Christopher Thomas says that exercise at any age makes a big difference to the rate at which you age. So his advice is that you should be thinking about slowing the ageing process now, no matter how young you are. "The best investment in our future is achieving good health and fitness in our twenties and the thirties as a platform for our 80s and 90s. While it's perfectly true that it is better late than never when it comes to a healthy diet and lifestyle, there is good evidence that periods of "going off the rails" create a legacy that may last for decades, even if good habits are later restored".



Fitness First's oldest member

Hilda Little is living proof that fitness and long life go together. At 95, she still trains three times a week at Perth's Cannington club and has no intention of quitting any time soon.

When you first meet Hilda Little, it's hard to believe she's 95. We're so conditioned to expect that anyone five years short of 100 would be barely functioning that it comes as a bit of a shock to hear her strong, clear voice and hearty laughter. Fitness First's oldest member sounds so much younger than she is.

"I don't feel 95, except when I try to get out of bed, and then I feel like 150!" she laughs.

Hilda enjoys talking about her long love of fitness, which began as a teenager in the 1930s in England, when she chose swimming lessons instead of following her friends into night school. She has swum and worked out ever since.

When she trains at the Cannington club Hilda still likes to swim the breaststroke and backstroke and walk up and down the pool for up to two hours three times a week. She used to do Aqua Aerobics classes but when she turned 95 her doctor advised her to slow down and just do training on her own.

We asked Hilda whether she believed that her lifetime of training had contributed to her surprisingly good health at 95.

"There is no two ways about it," she said. "I've always walked a tremendous amount and swam a lot. When I was in my 20s I was told that exercising would stand me in good stead when I hit my forties and fifties. And now I am 95!"

Still searching for more secrets to her enduring wellbeing, we asked whether she was on any kind of special nutritional regime or special diet.

"Special diet? Good Lord no, I mean I have dieted on and off through the years but not now," she said.

Hilda has her main meal of the day at 1pm and it usually consists of meat and three vegetables. "We were brought up on that," she says. "Of course, in the old days we grew our own vegetables, and the local butcher was around the corner and he was a good one."

Hilda likes to train in the afternoons, and her post-workout meal consists of a cup of tea and a biscuit, or a bit of cake.