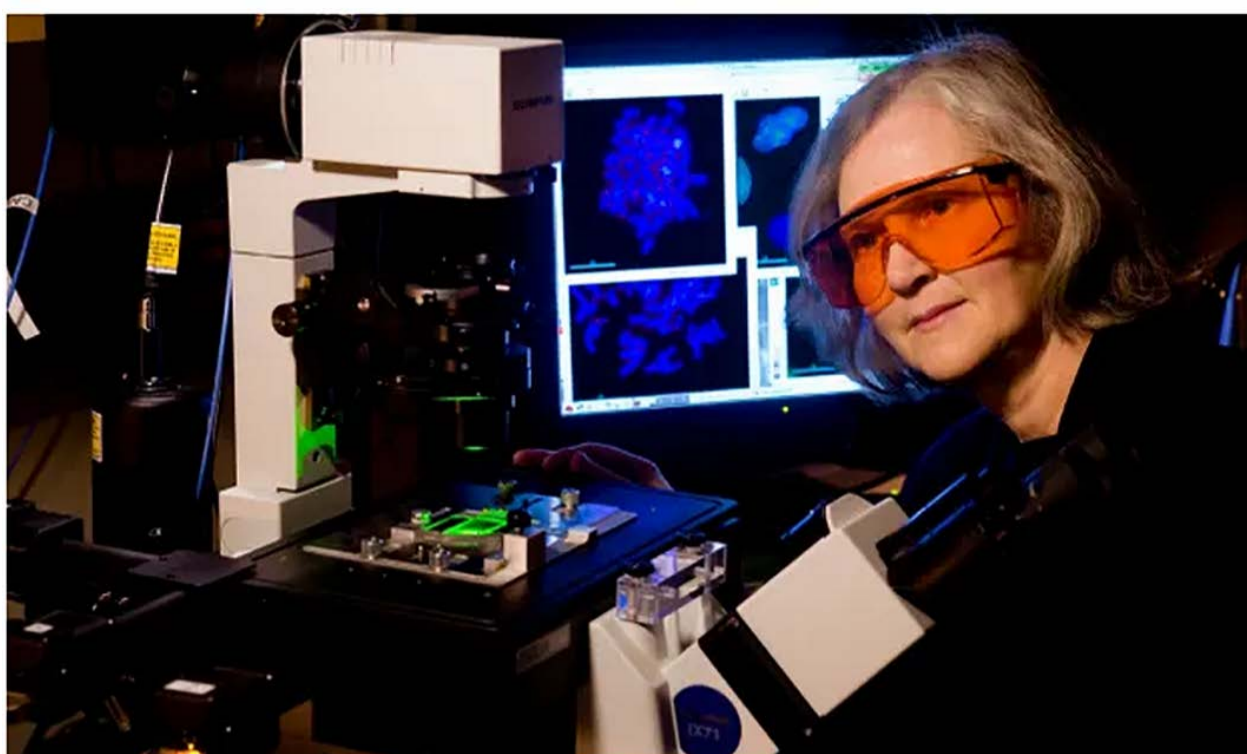


# Elizabeth Blackburn on the telomere effect: 'It's about keeping healthier for longer'

The Nobel winner says keeping telomeres - the ends of our chromosomes - in prime condition can stave off diseases associated with ageing



▲ Professor Elizabeth Blackburn in her lab before her Nobel prize award in 2009 Photograph: Micheline Pelletier Decaux/Corbis via Getty Images

**You won your Nobel prize for medicine for your discoveries concerning telomeres, found at the ends of chromosomes. What are telomeres and what happens to them as we age?**

If you think of your chromosomes - which carry your genetic material - as shoelaces, telomeres are the little protective tips at the end. They are made of repeating short sequences of DNA sheathed in special proteins.

During our lives they tend to wear down and when telomeres can't protect chromosomes properly, cells can't replenish and they malfunction. This sets up physiological changes in the body which increase risks of the major conditions and diseases of ageing: cardiovascular disease, diabetes, cancer, a weakened immune system and more. But the process is somewhat malleable. It is happening in all of us at some rate, but the rate can change. An enzyme called telomerase can add DNA to the ends of chromosomes to slow, prevent and partially reverse the shortening.

**Can you delay or reverse ageing by taking care of your telomeres?**

We all have health spans - the number of years we remain healthy, active and disease-free - and the shortening of our telomeres contributes to ageing and our entry from health span into disease span. But we can [do things that] affect our telomerase and telomeres, that can [delay] entry from health span to disease span. So we are talking more about keeping people healthier for longer and staving off some diseases of ageing. This is not about extreme life span extension - though of course staying healthier longer does have a reflection in mortality rates.



**In the book you argue that to lengthen our telomeres, or at least stop them shortening, we need to improve our lifestyle by managing chronic stress, exercising, eating better and getting enough sleep. A lot of these things are recommended already - so what is new?**

People hadn't understood why at the cellular level the sorts of things that are recommended to improve lifestyle can help stave off disease. One reason is because they are helping you maintain telomeres. The book integrates a lot of new studies - from genetics, epidemiology and social science - that have been accumulating. We also provide a new biological underpinning to the mind-body connection. Nobody had any idea that meditation and the like, which people can use to reduce stress and increase wellbeing, would be having their salutary and well-documented useful effects in part through telomeres. The book is also recognising how much control we can have. Small tweaks in how you approach stress, for example, can lead to long-term habits that make a difference.

**One of the criticisms of the book is that it is a bit glib. That ageing is too complicated to simply boil down to these entities at the end of chromosomes...**

This is one of many processes of ageing, and we say that. We are focusing on one mechanism which has relatively recently been recognised in humans and that we can have some control over.

**What exercise can help preserve our telomeres?**

The good news is you don't have to go to the gym three hours a day or run a marathon a week. People who do moderate aerobic exercise - about three times a week for 45 minutes - have telomeres pretty much as long as marathon runners. Mixing things up seems to be good too. One study showed the more different kinds of exercise people did, the longer their telomeres. Many studies looking at people under severe chronic stress find their telomere shortness relates to how severely that stress is experienced. But that relationship seems particularly strong in sedentary people. Even 10-15 minutes of light exercise daily appeared, in one study, to buffer the effect.

## How quickly can telomere length change?

You can see the effects of interventions in as little as a few months. But it is really the long-term changes, over periods of a year to 10 years, that are going to be predictive of increased health span.

## Commercial tests are available for telomere length, with prices in the US ranging from about \$100 to \$500. Should we all get our telomere lengths tested?

The answer is no. I see no harm in it, but it doesn't mean a whole lot. You could be long one year and short another year. We know enough about telomere maintenance from a lot of studies to know the kinds of things that we can and should do. You want to do them regardless of what the test said.

## Have you had your telomeres tested?

I had them tested because I was part of a research study. It turned out I had long telomeres. But that can change, so that test result doesn't stop me from taking seriously these lessons I have learned from all the research. I do try to build these things into my life. I exercise, but I don't spend hours at the gym; I have a good diet, but am not fanatical about food; and I try to think about the effect of stress. I practice micro-meditations which I think help.

## There are pills that, it is claimed, have telomere lengthening effects, and at least one US company is developing telomerase gene therapy with the aim of reversing ageing. Are they a good idea to take?

These are things that purport to increase telomerase activity, but they are very untested and the studies that have been done have only been done by those who actually market these products. There is a caution too because telomerase has a good side (lengthening telomeres) but it can also have a bad side. Higher levels of it are associated with higher risks of brain tumours, melanoma and non-smokers' lung cancers. Things like exercise, stress reduction and good diet, on the other hand, have never been shown to increase cancer risk, and indeed some studies show they decrease those risks.

## After your experience on President Bush's Council on Bioethics - **you were kicked off in 2004**, many think for your support of human embryonic stem cell research - how do you feel about **President Trump and his attitude to science**?

We need to be active. I am the president of a scientific research institute [[the Salk Institute in San Diego](#)]. We have to keep making clear statements about what sorts of things are important principles - including that science works because there is real respect for the truth. I expect there is going to be a mass shortening of telomeres around the country related to the chronic severe stress that will be a consequence if a number of Trump's policies come to pass. There is a likelihood of all these very burdensome diseases of ageing going up. We are in for big individual and societal costs.

● *The Telomere Effect: A Revolutionary Approach to Living Younger, Healthier, Longer* by Elizabeth Blackburn and Elissa Epel is published by Orion Spring (£14.99). To order a copy for £12.74 go to [bookshop.theguardian.com](http://bookshop.theguardian.com) or call 0330 333 6846. Free UK p&p over £10, online orders only. Phone orders min p&p of £1.99