

# Molecular biologist Elizabeth Blackburn reveals telomere effect

BY ANNA MAXTED

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ELIZABETH Blackburn is the Hobart-born, Nobel prize-winning molecular biologist who discovered one of the greatest secrets about life: how to slow down ageing. We're meeting at a London hotel to discuss her book, *The Telomere Effect*, already a *New York Times* bestseller.

Part of our chromosomes, telomeres are the DNA — comparable to the protective plastic tips at the end of shoelaces — that keep our genetic material from unravelling, which is what leads to disease and premature ageing. Good cell renewal in our stem cells promotes health and feeling young: fluid joints, excellent lung capacity, a strong immune system, a sharp brain and a healthy heart. If cells don't have telomere maintenance, the telomeres shorten and die.

Blackburn's discovery was made in a 1975 study of pond scum at Yale University, for which she jointly won the 2009 Nobel Prize in Physiology or Medicine. It has grown into a field of global science, with studies evincing that lifestyle, twists of fate and even attitude can lengthen, maintain or wage a war of attrition on telomeres. This means it is in our power to slow the cellular rate at which our bodies age, thereby extending our youthfulness and reducing our risk of cancers, diabetes, cardiovascular disease and Alzheimer's.

"The common run of us, that's what we die of," says Blackburn, 68, apple-cheeked with greyish-blond wavy hair and a deceptively unassuming manner.

"And so the question is, can you push them back and minimise the chances of their probability of happening and their severity and progression? We could really think of how to forestall some of these if we knew the kinds of factors - and we do - that will have quantifiable effects on these rates."

Chronic stress has been well documented as nibbling away at our telomeres, but it is also proven that negative thinking compounds the damage. "In some ways, it was: surprise, surprise," Blackburn says.

"In another, it was: of course! You're frightened, you're angry, your heart beats, your gut churns. We know our mind is having clear physiological effects in those short-term ways. There are stress hormones that course

throughout your body and bathe your cells, and your cells respond. Among those was the maintenance of telomeres.”

Studies on white blood cells (‘the window of the immune system’) showed a link with ‘things we thought were very hard to get a grasp on. What is a negative frame of mind? But it correlated. The more people scored on this pessimism scale’ - which was tested with ‘hidden questions, like in the John le Carre spy stories’ so participants couldn’t game the system - ‘the shorter their telomeres.’

So if you are always moaning about your awful luck, or assess yourself unkindly when looking in the mirror, you are biologically hastening your ageing. This, we agree, is a serious argument for getting your highlights done, which she does “every several months; not too much exposure to - anything.’

Broadly defined, a telomere-shortening attitude is when you react to pressure with the ‘threat-stress’ response, causing your blood vessels to constrict, whereas the healthier, bring-it-on attitude of the ‘challenge-stress’ response allows more blood to flow to heart and brain and a brief, energising spike of - cortisol.

If you deploy the threat-stress response every time someone shuts a door, your cortisol creeps up and stays high but blunted.

Likewise, if you’re quick to suspect people’s motives (as in “Mum?” “Oh, what is it now?” “Er, could I have a hug?”) your telomeres suffer.

As defined in a British study of civil servants, the attitude of ‘high cynical hostility ... goes with a bad telomere-maintenance profile.’ The most hostile men were 30 per cent more likely to have short telomeres.

Blackburn sighs.

“I love that. I have this image of all these Whitehall civil servants, the cynically hostile ones.”

Yet telomeres hate cynical hostility, which is essentially another way of magnifying threat.

“Immune cells have to have a bottom-line level of telomere maintenance — cortisol actually damps down that maintenance.”

We may not be able to escape a chronic stress source such as a gruelling job or caring for an ill relative, but Blackburn says we can train ourselves to develop ‘stress resilience’.

Studies show our perception of how stressed we are, rather than the situation, ‘is the big determinant. Being under chronic stress does not inevitably lead to telomere damage.’

Behaviours to promote good mental health include focusing on what’s in front of you. ‘Mind-wandering — ‘Oh, I wish I was somewhere else’ — correlated with negative telomere maintenance.’

Also beneficial is distancing thoughts from negative emotions by addressing yourself in the third person: ‘What is Donald angry about?’

And if the Lululemon crowd is up for traditional yoga that involves chanting and tapping fingers, Kirtan Kriya exercise has near-miraculous effects. A study at the University of California, Los Angeles of people caring for relatives with dementia found their telomerase rose by 43 per cent after they practised it for 12 minutes a day for two months. The control group listening to soothing music boosted their telomerase by a piffling 3.7 per cent.

Exercise is good – no surprise!

It’s no surprise that 45 minutes of cardiovascular exercise three times a week is good for telomeres.

However, Blackburn conducted a study with her colleague, co-author of *The Telomere Effect* and health psychologist Elissa Epel, to investigate telomere maintenance in relation to mindset and lifestyle.

It emerged that if people were under severe stress, even 15 minutes of exercise — enough to break out in a sweat; you could run up and down the stairs a few times if your lunchtime’s short and you don’t have time to go to the gym or go swimming — was enough to substantially buffer the shortening or the effect on the telomeres.

Blackburn stresses that making any tweak to improve telomere maintenance helps. But the list of telomere enemies is overwhelming: bacon, anxiety, excess belly fat, irregular sleep patterns and permethrin (which treats lice)! And how do we avoid pollution if we live in the city? “You can walk in Hyde Park,” Blackburn says.

Yet it’s not just what you do, it’s who you know. Your relationships also affect telomere maintenance.

So sex in marriage, which is presumably indicative of not hating each other, boosts your telomeres?

“That was the observation,” she says. “There it was, there was a relationship, it tied in - a relationship with another human being, in a meaningful, good way. I don’t think it was one night. It was in the context of a serious relationship.”

Meanwhile, a study on people who had recently divorced found that telomere length was significantly shorter than in people who were single or had been married long-term.

“You stop and think, ‘There’s an obvious stressor’,” Blackburn says. “We are intensely social beings.”

Blackburn is president of the Salk Institute for Biological Studies in San Diego, ‘a life adventure’ after 38 years in San Francisco with her husband, the scientist John Sedat. They raised their son, Benjamin, there. The couple

met when she was doing her PhD at Cambridge with Fred Sanger “just as DNA sequencing was beginning. That led me into thinking: ‘I don’t know what’s on the ends of chromosomes and nor does anybody else.’

Blackburn walks the walk, trotting to work, 30 minutes through neighbouring streets.

“And people greet each other. I arrive at work and I’m really up. And you realise, ‘Yes, these things are important.’ I resolve now to smile at people.” The lack of cynical hostility bodes well. In San Francisco people on the bus detailed their stresses to her. Talking of which, I mention my concern about a note in *The Telomere Effect* that ‘looking haggard’ may indicate that your telomeres need more protection.

Blackburn reassures me:

“It’s a rough correlate. It’s not a huge sign, but it is a sign. Statistically speaking, there is an effect. But the really more significant things are happening inside us.”

She’s wary of expensive “anti-ageing” telomerase pills or creams, whose safety has been questioned and which have little scientific data proving that they are effective.

“Everything in the book you can do for free,” she says. “And that’s what’s so reassuring. People can take control themselves.”

*The Times - The Telomere Effect by Elizabeth Blackburn and Elissa Epel (Orion, \$32.99)*

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