Harsh world makes kids' chromosomes look middle-aged

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Children growing up in severely disadvantaged circumstances can experience drastic chromosome ageing. By the time they are 9 years old their telomeres – the caps on the ends of chromosomes that shrink each time cells divide – can be as short as those of someone decades older. And a particular combination of genes seems to make children flourish in nurturing environments but suffer in harsh environments.

Daniel Notterman from Penn State University in University Park and colleagues found the effect in a group of 40 9-year-old boys, half of whom were from extremely harsh backgrounds and half from privileged ones.

Telomeres protect chromosomes from damage, so their shortening over time is thought to be responsible for some of the negative effects of ageing.

Children whose mothers had changed partners more than once by the time they were 9 had telomeres 40 per cent shorter than those whose mothers didn't change relationships. And those with mothers who'd gone to college had 35 per cent longer telomeres than those who didn't, on average. They also found shorter telomeres were associated with harsh parenting and younger mothers.

Early intervention

"The social environment really conditions the way that these children are living, and their health," says Notterman. "The fact that these people have early telomere shortening by the age of 9 could be an argument for some people who want to intervene earlier in the lives of children, by getting them in school, for example."

Notterman warns the link between shorter telomeres and health outcomes is not fully established. "But whatever [the result], it's a very profound change," he says. "Whatever the relationships are, there has been a robust and fixed biological change in the organism – in the human being – by the time these children are 9."

The team also found that particular genetic mutations seemed to make kids more sensitive to their environment whatever it was. Those with a certain combination of mutations that code for the neurotransmitters serotonin and dopamine had the longest telomeres when they were in the "privileged" environment, and the shortest in the harsh environment.

"The fact that they're looking at children is really interesting," says Hilda Pickett from the Children's Medical Research Institute in Sydney, Australia. Since telomeres get shorter over time, finding changes so early is surprising, she says.

And Pickett says the genetic links could be pointing towards a mechanism by which stress can shorten telomeres, which has so far remained elusive. But exactly how dopamine and serotonin are involved would require more research.

She points out that while some of the results – like the association with family structure changes – are statistically significant, others are not because of the small sample size.

That's the next step, says Notterman, who plans to extend the study to include a 1000 children who will be followed up at age 15.

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