Telomere stress reveals insight into ageing

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Scientists at Newcastle University have unlocked clues that give us a greater understanding of the ageing process.

In research published in the journal Nature Communications, the team, led by Dr. João Passos, has shown that stress-induced damage to the ends of our chromosomes may be an important factor.

Cells in our bodies divide to replace cells that are worn out or damaged. During this division, copies of our genetic material are passed on to the next generation of cells. The genetic information inside cells is arranged in twisted strands of DNA called chromosomes and at the end of these strands is a protective telomere 'cap'. Previous research has shown that telomeres get shorter each time a cell divides. This shortening has been linked to the aging process because cells are no longer able to divide past a critical minimum telomere length.

While current thinking on how telomeres affect ageing has focused mainly on telomere length, this new research highlights that there is considerably more to the story.

Dr. João Passos said: "As we age, telomeres do indeed get shorter, and premature shortening of telomeres heightens the risk of diseases and death. However, our findings show that telomeres in both humans and mice are particularly susceptible to DNA damage and that stress-induced damage to telomeres, even long ones, is irreparable and increases with age."

As we grow old, cells progressively accumulate damage to DNA - the molecule containing the genetic information that is necessary for the development and functioning of all living organisms. However, this damage - which is mostly caused by free radicals - can be fixed by the cells repair machinery.

The research is the outcome of Dr. Passos' Biotechnology and Biological Sciences Research Council (BBSRC) funded David Phillips Fellowship.

The Newcastle University discovery shows that ends of chromosomes are particularly sensitive to stress and are not so efficiently repaired. Damage within telomeric regions remains unrepaired and this helps to explain why cells lose their ability to regenerate as they age.

"This discovery improves our understanding of how telomeres impact on cellular ageing. We now know that telomeres are unusual in the way they respond to damage and that it is not only their length that counts as our cells age", said Dr. Passos. "Future research will need to focus on unravelling the properties which make these regions of the genome so special, so that we can devise therapies to improve telomere repair."