Bigger is not better when it comes to lifespan

December 2 2015

A study looking at how DNA changes with body size may help scientists to explain why taller individuals tend to have shorter lives.

The new findings, based on wild house sparrows, and published today, show how changes in DNA that are linked to ageing and lifespan take place as body size gets bigger.

Although larger types of animals tend to live longer than smaller ones – elephants live longer than mice – within many species the bigger individuals have shorter life spans than their smaller counterparts – a Jack Russell has a much longer life than a St Bernard. In humans, a recent study has shown that taller people are more prone to diseases including cancer. But biologists haven't been able to fully explain why.

Research into telomeres, special DNA structures that all animals have at the ends of their chromosomes, described as functioning like "the protective plastic caps at the end of shoelaces" may provide the answer.

The study, conducted jointly by the University of Glasgow's Institute of Biodiversity, Animal Health & Comparative Medicine and the Centre of Biodiversity Dynamics at the Norwegian University of Science and Technology, focused on a population of wild house sparrows on the isolated island of Leka in Norway.

The research, published in the *Proceedings of the Royal SocietyB: Biological Sciences*, found that skeletally bigger house sparrows had shorter telomeres. This relationship was maintained during a period when a selective breeding programme on the island resulted in the sparrows becoming even larger. In tandem, their telomeres became even shorter.

Everyone's telomeres erode over time, and telomere shortening has been linked to ageing and disease risk including cancer. Having naturally longer telomeres appears to give individuals an advantage when it comes to health and the biological aging process. The results shed light on a paradox that has puzzled biologists for a long time. If being bigger gives you a competitive advantage, why don't animals just get bigger and bigger? Part of the answer is that growing big can mean more telomere loss and faster ageing.

Professor Pat Monaghan, Regius Chair of Zoology at the University of Glasgow, who supervised the telomere analysis, said: "Growing a bigger body means that cells have to divide more. As a result, telomeres become eroded faster and cells and tissues function less well as a result.

"The reason why the bigger individuals have shorter telomeres might also be related to increased DNA damage due to growing faster. Being

big can have advantages, of course, but this study shows that it can also have costs."

Associate professor in population ecology Thor Harald Ringsby at Norwegian University of Science and Technology who was running the fieldwork together with his colleagues in Norway said: 'The results from this study are very exciting and broad reaching. It is especially interesting that we obtained these results in a natural population. The reduction in telomere size that followed the increase in body size suggests one important mechanism that limits body size evolution in wild animal populations"

The study, entitled 'On being the right size: increased body size is associated with reduced telomere length under natural conditions' is published in the *Proceedings of the Royal Society B: Biological Sciences* journal. The research was funded by the European Research Council and the Research Council of Norway.

More information: On being the right size: increased body size is associated with reduced telomere length under natural conditons, *Proceedings of the Royal Society B*: *Biological Sciences*, rspb.royalsocietypublishing.or … .1098/rspb.2015.2331

Provided by University of Glasgow