Conservation Research: Ground-breaking Turtle and Tortoise Study Challenging Evolutionary Theories of Ageing

It is one of the irrefutable facts of life – as humans we age as we get older. We slow down and weaken physically and mentally, and – the one that most of us dread – we lose our youthful looks! All over the world, life expectancy for most communities has increased significantly over time, but despite all the advancements we cannot stop the ageing process. However, it may be possible to slow that trend in the future: **a new study of ageing in tortoises and turtles has revealed a different pattern of ageing compared to humans and other species.**

At 190 years, Jonathan is the world's oldest tortoise *– Photo from the Guardian*

In a new study published in the journal *Science*, researchers used data contributed by Kadoorie Farm and Botanic Garden (KFBG) in collaboration with other zoos and aquariums to examine 52 species of turtles and tortoises. Evolutionary theories of ageing predict that all living organisms weaken and deteriorate with age (a process known as senescence) – and eventually die. Now, using data captured by KFBG and others, researchers from the Species360 Conservation Science Alliance and the University of Southern Denmark have shown that certain animal species, such as turtles and tortoises, may exhibit slower or even absent senescence when their living conditions improve. Out of 52 turtle and tortoise species, 75% show extremely slow senescence, while 80% have slower senescence than modern humans.

"We find that some of these species can reduce their rate of ageing in response to the improved living conditions found in zoos and aquariums, compared to the wild," says study co-author, Prof. Dalia Conde, Species360 Director of Science and head of Species360. “In addition, modern zoological organisations play a significant role in conservation, education and research,” she adds. This study is an excellent example of the immense contribution that conservation centres, zoos and aquariums make in keeping records that can help advance scientific discovery.

KFBG is a member of Species360, a non-profit organisation that maintains the Zoological Information Management Systems (ZIMS) – the largest database on wildlife in human care. As part of our commitment to conservation and providing high standards of animal care, we use ZIMS to keep detailed records of our rescued animals and our animal collection. As a holder of turtles and tortoises, we actively collect and share data in ZIMS on these species, and this information has directly contributed to this study.

Elongated tortoise at KFBG *– Photo from the Wild Animal Rescue Centre.*

Turtles continue growing after sexual maturity

Some evolutionary theories predict that senescence appears after sexual maturity as a trade-off between the energy an individual invests in repairing damage within its cells and tissues and the energy it invests in reproduction, enabling its genes to be passed to following generations. This trade-off implies, among other things, that after reaching sexual maturity individuals stop growing and start experiencing senescence, a gradual deterioration of bodily functions with age. Theories predict that such trade-offs are unavoidable, and thus senescence is inevitable. In fact, this prediction has been confirmed for several species, particularly mammals and birds.

However, organisms that keep growing after sexual maturity, such as turtles and tortoises, are believed to have the potential to keep investing in repairing cellular damage and are thus thought to be ideal candidates for reducing and even avoiding the harmful effects of ageing.

"It is worth noting that the fact that some species of turtles and tortoises show negligible senescence does not mean they are immortal; it only means that their risk of death does not increase with age, but it is still larger than zero. In short, all of them will eventually die due to unavoidable causes of mortality such as illness," says Dr. Fernando Colchero, Principal Statistical Analyst, Species360, and one of the researchers behind the study.

Golden coin turtle hatchling at KFBG *– Photo from the Wild Animal Rescue Centre.*

Turtles and tortoises may not live forever, but they do have the ability to live much longer than almost any other species. KFBG manages an assurance population of golden coin turtles, a species close to extinction in the wild. The centre also supports in-situ conservation efforts to protect the native big-headed turtle. Another important role played by KFBG involves the rehoming of turtles and tortoises seized from the illegal wildlife trade. It seems that as a surprise by-product, in the studies associated with these programmes, we may be contributing to longevity as well!

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