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Tassie devils fight killer disease through evolution

Rapidly declining Tasmanian devils could save themselves from a lethal disease decimating their low populations, a new study has found.

Research involving Griffith University, published today in *Nature Communications*, suggests devils are swiftly evolving over a short period of time to resist devil facial tumour disease.

The infectious cancer has been killing wild Tasmanian devils for the past 20 years, with populations declining by at least 80 per cent. The disease kills most devils at sexual maturity and they now raise a single litter instead of three.

Following the extinction of the thylacine, the world's largest marsupial predator, in the 1930s, researchers and managers are working hard to make sure the Tasmanian devil does not suffer the same fate.

Devils still persist in places where the disease appeared more than 20 years ago, despite models predicting that they should now be extinct.

Professor Hamish McCallum, of Griffith's School of Environment and Environmental Futures Research Institute, says, "Models I published seven years ago predicted that these populations should now be extinct. I am very glad that I was wrong – it appears that the devils are saving themselves through evolution".

Long-term research by study author Menna Jones, of the University of Tasmania, dates back to a tissue archive for devils in 1999, five years before research on devil facial tumour disease began.

The archive, built with samples from her research group and from the State Government's Save the Tasmanian Devil Program, now represents one of the best resources globally for studying evolution of an emerging infectious disease in wildlife.

In an international collaborative effort, evolutionary geneticist Andrew Storfer at Washington State University and genomicist Paul Hohenlohe at the University of Idaho compared the frequency of genes in specific regions of pre-disease DNA samples to the frequency of genes in corresponding regions of DNA samples collected up to 8-16 years following DFTD emergence at three independent sites across Tasmania.

The rapid evolution occurred in as little as 4 to 8 generations of devils since the disease outbreak.

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Researchers identified two small genomic regions in the DNA samples from all three sites that have changed significantly in response to the strong selection imposed by the disease. Five of seven genes in the two regions were related to cancer or immune function in other mammals, suggesting that Tasmanian devils are indeed evolving resistance to DFTD.

“The results are surprising because rapid evolution requires pre-existing genetic variation and Tasmanian devils have low levels of genetic diversity,” says Hamish McCallum.

“While the research suggests that devils in the wild may save themselves through evolution, it is essential to develop management strategies that assist them to do so.

“Cancer usually arises and dies with its host but in only two known cases in vertebrates - canine transmissible venereal cancer in dogs and DFTD - cancers have taken an extraordinary evolutionary step to become transmissible.

“They spread not just within their host but to other animals, effectively becoming immortal. DFTD presents a unique research opportunity to study the early stages of the evolution of a new disease and transmissible cancer with its animal host.

“This is a bizarre cancer in a unique Australian marsupial, but the disease and the way that the Tasmanian devils respond can provide new general insights into cancer biology” Professor McCallum said.

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