Why humans outlive apes

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The same evolutionary genetic advantages that have helped increase human lifespans also make us uniquely susceptible to diseases of aging such as cancer, heart disease and dementia, reveals a study to be published in a special *PNAS* collection on "Evolution in Health and Medicine" on Tuesday, Jan. 26.

Comparing the life spans of humans with other primates, Caleb Finch, ARCO & William F. Kieschnick Professor in the Neurobiology of Aging in the USC Davis School of Gerontology, explains that slight differences in DNA sequencing in humans have enabled us to better respond to infection and inflammation, the leading cause of mortality in wild chimpanzees and in early human populations with limited access to modern medicine.

Specifically, humans have evolved what Finch calls "a meat-adaptive gene" that has increased the human lifespan by regulating the effects of meat-rich diets. ApoE3 is unique to humans and is a variant of the cholesterol transporting gene, apolipoprotein E, which regulates inflammation and many aspects of aging in the brain and arteries.

"Over time, ingestion of red meat, particularly raw meat infected with parasites in the era before cooking, stimulates chronic inflammation that leads to some of the common diseases of aging," Finch said.

However, another expression of apolipoprotein E in humans -- the minor allele, apoE4 -- can increase the risk of heart disease and Alzheimer's disease by several-fold, Finch explained. ApoE4 carriers have higher

totals of blood cholesterol, more oxidized blood lipids and higher rates of early onset coronary heart disease and Alzheimer's disease.

"The chimpanzee apoE functions more like the "good" apoE3, which contributes to low levels of heart disease and Alzheimer's," Finch said. Chimpanzees in captivity have unusually low levels of heart disease and Alzheimer-like changes during aging when compared to humans.

Finch hypothesizes that the expression of ApoE4 in humans could be the result of the "antagonistic pleiotropy theory" of aging, in which genes selected to fight diseases in early life have adverse affects in later life.

"ApoeE may be a prototype for other genes that enabled the huge changes in human lifespan, as well as brain size, despite our very unape-like meat-rich diets," Finch said. "Drugs being developed to alter activities of apoE4 may also enhance lifespan of apoE4 carriers."

In spite of their genetic similarity to humans, chimpanzees and great apes have maximum lifespans that rarely exceed 50 years. Even in high-mortality modern hunter-forager populations, human life expectancy at birth is still twice that of wild chimpanzees.

Provided by University of Southern California