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**By Janelle Weaver**

# Age assay for forensics toolkit

## A test that tracks declines in T cell byproducts can estimate a person's age from a blood sample, and may someday help identify victims or perpetrators of crimes

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A smudge of blood at a crime scene may provide enough evidence for investigators to determine the age of criminals or victims, thanks to a new procedure that analyzes the age-related loss of specific DNA molecules in immune cells.

**Blood droplets**

The approach is more reliable than other genetic analyses and does not involve the destruction of evidence, forensic molecular biologist Manfred Kayser, whose study was published online today (22 November) in *Current Biology,* told *The Scientist.*

T cells must develop different types of surface receptors so that they can recognize and respond to a wide range of foreign pathogens. Inside the thymus, gene segments encoding T-cell receptors rearrange to produce distinct receptors, and as a byproduct, some deleted DNA sequences form circular fragments inside the cell called signal joint TCR excision circles (sjTRECs). As the function of the thymus declines with age, so does the number of sjTRECs.

Taking advantage of this phenomenon, Kayser and colleagues at Erasmus Medical Center developed a new technique that uses sjTREC abundance to approximate age.

"This is an important advance because it's better than what's available today, but there certainly are circumstances where one could be fooled," said David Wiest, an immunologist at Fox Chase Cancer Center who was not involved in the research.

The approach will be most useful in criminal cases in which investigators find only blood stains or body parts rather than bones or teeth, he said. Still, he added, the technique cannot offer pinpoint precision because the amount of sjTREC could be influenced by chronic stress and medical interventions, such as chemotherapy and surgical treatment for prostate cancer, as well as diseases that affect the immune system, such as leukemia and HIV/AIDS. These all represent challenges to the immune system, which are often associated with a decrease in the functioning of the thymus, the organ where T cells mature and produce sjTRECs.

The method is only useful for blood, not skin samples, Kayser said. Other genetic techniques used to estimate age include the analysis of the length of telomeres, or the accumulation of mitochondrial DNA deletions. Non-genetic approaches include the analysis of tooth development in children or tooth wear in adults, histological techniques that track different structures in bone sections, or medical imaging tools that measure bone formation and fusion. These non-genetic approaches are more accurate in children than adults.

In the study, the researchers assessed sjTREC levels using quantitative real-time polymerase chain reaction applied to whole-blood samples from 195 healthy Dutch volunteers ranging in age from a few weeks to 80 years. They compensated for variations in the total amount of DNA by comparing the quantity of sjTREC to levels of a gene product that does not deteriorate over time. They found that the abundance of sjTREC correlated strongly with age and accurately predicted age categories, each spanning 20 years. The values were equivalent for both fresh and older (18 months) samples, and the procedure worked for DNA samples as small as 50 nanograms in older individuals and 5 nanograms in young people. The accuracy of the technique is better than other DNA-based strategies and similar to that of skeleton-based analyses used in adults, Kayser said.

But the data are too variable for the method to provide confident estimates, said Yves Barral, a molecular cell biologist who studies aging in yeast at the Swiss Federal Institute of Technology and was not affiliated with the study. "Aging is not a process that functions by a clock," he told *The Scientist.* "We all age at different rates, depending on the period in our life and how much stress we experience."

Given that age categories were quite broad, some scientists say the approach isn't ready for prime time yet. "This is very preliminary," said George Tsokos, an immunologist at Harvard University. "We will need much more information about the parameters that affect TRECs before this is reliable, and we're a long way from admitting it to court."

Kayser and his team plan to examine other factors that could alter their estimates, such as geographic origin and health status.

But perhaps there are too many factors that scientists would have to take into account for the assay to ever achieve greater accuracy, said Stephen Grant, who studies the genetic basis of aging at the University of Pittsburgh and was not involved in the research. "This is such a novel idea that we may later find there are so many variables that affect the rate of loss of these circles that ignoring them is the best we can do," Grant said.