Age estimation from blood has immediate forensic application

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In principle, the new profiling method could be put to immediate practical use by law enforcement, according to the researchers who report their findings in the November 23rd issue of *Current Biology*, a Cell Press publication. They have already begun the required validation of the test, which is designed to assure that quality standards are met.

"We demonstrate that human age can be estimated from blood with reasonable accuracy using a simple, robust, and sensitive test assay," said Manfred Kayser of the Erasmus MC University Medical Center Rotterdam in the Netherlands. "Our method is applicable in situations where only bloodstains are available, which covers a large proportion of crime cases."

The method will be especially useful in forensic cases in which age information is important to provide investigative leads for finding unknown persons, Kayser added. Existing methods for age estimation have limited use for crime scene investigation because they depend on the availability of teeth, bones, or other identifiable body parts having physical features that allow age estimation by conventional methods.

Other proposed genetic or biochemical methods to estimate age from blood samples have suffered from low accuracy and technical problems, Kayser said. The new method takes advantage of a fundamental characteristic of immune cells known as T cells.

T cells play a key role in recognizing foreign invaders, an ability that

depends on a diversity of T cell receptors, each matching specific molecules (antigens) derived from bacteria, viruses, parasites, or aberrant cells such as tumor cells. That diversity of receptors is achieved through a specific rearrangement of the T cells' DNA, a process that produces small circular DNA molecules as a by-product. The number of those circular DNA molecules (known as signal joint TCR excision circles, or sj TRECs for short) declines at a constant rate with age.

"With our test assay, we quantify the amount of sjTRECs in the total DNA extracted from a small blood sample and use a reference gene not affected by age to compensate for the total amount of DNA in the sample," Kayser explained.

The approach allows accurate estimation of age, give or take nine years, the researchers report, suggesting that it would be highly accurate in placing unknown persons into generational categories spanning about 20 years.

Kayser said that the test currently has the highest accuracy of any test designed to estimate a phenotypic human trait from DNA information. Notably, its prediction accuracies are comparable to or better than those recently demonstrated for predicting brown versus blue eye color from DNA, a test that has already been put to forensic use.

These new tests are harbingers of what's to come as researchers uncover new methods designed to reconstruct the appearance of unknown persons from biological crime scene samples or remains. The hope is that such methods will ultimately mean more crimes solved, the researchers say.

"Conventional DNA profiling applied in forensics can only identify persons already known to the investigating bodies, because the approach is completely comparative," Kayser said. "Hence, every forensic lab is

confronted with cases where the DNA profile obtained from the evidence material does not match that of any known suspect tested, nor anybody in the criminal DNA database, and such cases therefore cannot be solved so far. In such cases, it is expected that appearance information estimated from evidence material will help in finding unknown persons."

More information: www.cell.com/current-biology/home

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