Could epigenetic age acceleration, not actual age, better predict how well you remember?

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A study led by researchers at Stony Brook University shows that age acceleration, when one's so-called biological clock runs quicker than one's actual age, is linked to poorer memory and slower rates of

processing information.

The team measured biological "clocks" derived from the DNA of 142 adults aged 25–65 years old and had the participants complete daily cognitive tests on smartphones. Their findings, which imply that epigenetic age acceleration could be a better indicator of how well a person remembers information and how quickly they work with information, are detailed in the *Journal of Gerontology: Biological Sciences*.

There are well-known chronological age differences in cognitive performance—on average, younger adults tend to remember more information and respond more quickly than older adults. One presumed explanation is biological wear-and-tear across life, but until recently there was not a way to test biological aging to explain these differences between younger and older people.

Aging researchers currently have significant interest in examining epigenetic patterns that change how the DNA in our cells fold and how genes behave. Unlike our DNA genome, which stays the same throughout our lifetime in every cell of our body, our epigenome can change through time and can be influenced by our behavior and environment. These epigenetic changes can thus indicate a person's biological age, which may differ from chronological age.

The researchers took blood samples and looked at patterns of DNA methylation at key sites in the human genome that are related to predictors of lifespan and mortality. While there are many types of epigenetic markers, scientists know the most about DNA methylation. They used these DNA methylation results to calculate five "clocks" of biological aging.

The participants completed a series of cognitive tests on smartphones to

gauge their performance on working memory and processing speed.

In one test participants saw a set of symbols on the top of the screen which they had to match to symbols on the bottom of the screen as quickly as possible. In another test, they viewed three red dots on a grid for a few seconds, then they were distracted by searching for "E's" in a screen of "F's." After this, they were asked to place the dots back to their original place on the grid.

The participants completed dozens of tests over two weeks, providing a profile of the person across different times of day, situations, and activities.

These profiles summarize their typical performance level, as well how much their scores fluctuated from one testing to another. Inconsistency is increasingly proposed to be a potential early indicator of dementia. These fluctuations could reflect the extra effort someone needs to put in to perform as usual.

Overall, the study results revealed the following:

- Positive age acceleration (meaning epigenetic age was greater than chronological age) was associated with poorer average processing speed and working memory.
- Positive age acceleration was also generally associated with greater inconsistency in working memory and processing speed, whereas being chronologically older was associated with less inconsistency.

"We found that when someone's epigenetic age was older than their chronological age, it predicted them being on average slower at matching symbols and worse at recalling the location of the dots. We also found that people whose DNA showed that they were older than their

chronological age had wider swings in their performance," says lead author Daisy V. Zavala, a doctoral candidate in the Department of Psychology.

"Even when we account for that some participants were, for example, 25 years old and others were 65 years old, knowing their epigenetic aging further could predict, for example, why one 65 year old did better than another 65 year old," adds Stacey Scott, Ph.D., Associate Professor of Psychology and a co-author.

"We found that age acceleration distinguished people's performance in in daily life, not just in the laboratory. And the effects of epigenetic acceleration were similar to or larger in size than the well-known chronological age differences between younger and older adults."

"Epigenetics is an exciting area of genomics, especially for understanding the interactions between genes vs. environment. There is still a huge amount we don't know about how epigenetics works, why our epigenome changes and what it tells us about our current and future health," says Krishna Veeramah, Ph.D., Associate Professor in the Department of Ecology and Evolution, a co-author, and population geneticist who led the DNA component of the research.

"In genomics terms, where researchers often work on thousands of genomes, this was a fairly small study. Yet, we were able to find a very clear relationship between our epigenome and cognitive performance."

This study is among the first to examine associations between chronological age and epigenetic age acceleration on daily cognitive performance.

The authors say that future research should examine the long-term cognitive implications of having a biological clock that runs quicker than

your actual age.

More information: Daisy V Zavala et al, Epigenetic Age Acceleration and Chronological Age: Associations With Cognitive Performance in Daily Life, *The Journals of Gerontology: Series A* (2023). DOI: 10.1093/gerona/glad242