# How old are we really?

**Ageing is a highly individual process. An international consortium coordinated by researchers in Konstanz has developed a method that uses biomarkers to determine a person's biological age – a valuable tool for research on ageing and the development of new approaches in preventive medicine.**

Is it possible to draw conclusions about an adult's physical condition on the basis of their age? The answer is: "It depends." On the one hand, it is well known that the body's ability to function decreases with age, while the risk for age-related illnesses increases over time. However, two people with the same age can also differ considerably in their physical ageing and health. A person's chronological age and their biological age are only connected to a certain extent. This is because biological age reflects a person's actual physical ageing process and depends on different factors such as their lifestyle, genetics and environment.

Yet how can we determine biological age as precisely as possible? This question is the focus of the international MARK-AGE consortium. In a cross-sectional study conducted across Europe, the researchers identified age-related changes in ten key blood values (biomarkers) of men and women respectively. These values make it possible to calculate a person's biological age. In a recent publication under the leadership of Maria Moreno-Villanueva and Alexander Bürkle from the University of Konstanz, the consortium put this "bioage score" to the test and used it to identify additional clinically relevant biomarkers linked to biological age.

## One biomarker is not enough

In the past, ageing research has suggested various biomarkers for determining a person's biological age, yet none of them was a strong enough indicator on its own. "The biological ageing process is very complex. It affects all of the body's tissues and organs, and it is not the result of a single cause. As a result, single biomarkers are not enough to reliably determine a person's biological age", Morena-Villanueva explains. "On top of this, there are also differences in how men and women age."

Thus, the MARK-AGE consortium used the approach of developing a separate combination of biomarkers for each sex that can be used to calculate an individual person's biological age. To this end, the researchers analyzed data on about 3,300 study participants from eight European countries, and the team recorded 362 different biomarkers on each participant. After analyzing this comprehensive data set, the team selected ten key biomarkers per sex that were used to calculate the bioage score of each person – a value reflective of a person's biological age.

## Ageing as an individual process

"If we look at the bioage scores of a lot of people born in the same year, we see a wide range of values. This shows very clearly that each person has their own individual biological ageing process and, for example, that some people are significantly younger biologically than their chronological age would seem to indicate", Morena-Villanueva says. The researchers were also able to confirm the validity of their approach by comparing their calculations with corresponding expectations of whether certain sub-groups of people were biologically older or younger than their chronological age.

Indeed, the scores showed that the difference between the biological and chronological age ("age difference") is significantly larger in people with trisomy 21 – a genetic disorder that is also tied to a faster ageing process. On the other hand, women over 50 who received hormone replacement therapy were biologically younger than those who did not. For women who smoke, the "age difference" increases with the total number of cigarettes smoked over the course of their lifetimes, i.e. smoking accelerates ageing in women from the MARK-AGE population. "Against the backdrop of current research on the ageing effects of smoking, hormone replacement therapy or trisomy 21, all of these results are plausible and confirm the validity of our bioage score", Bürkle explains.

## A step towards a new kind of preventive medicine

The researchers also used the bioage score to identify clinically relevant biomarkers in their data set that have a connection to biological age, but not to chronological age. They found this to be the case for certain lab values that are usually measured to assess a person's bone status, lipid metabolism or immune system function: 25-hydroxy-Vitamin D, HDL (High-Density Lipoprotein) and the share of T helper cells among leukocytes (CD3+CD4+/CD45+ ratio). The younger a person's biological age, the more likely the values for these markers were within a range that is generally considered to be good for health. This suggests that these markers play a direct role in the ageing process.

Overall, the study provides important findings for determining biological age while opening up new opportunities – in ageing research as well as in medicine. "Reliable biomarkers for biological ageing provide key tools for tracking the ageing process – even in healthy individuals – as well as for identifying people who have a higher risk of developing an age-related illness or physical impairment. This could open doors for new approaches to individualized preventive medicine", Bürkle concludes.

**Key facts:**

- **Original publication**: M. Moreno-Villanueva, M. Junk, […], A. Bürkle (2026) Biologically Younger Individuals, as Identified by MARK-AGE Biological Age Scores, Display a Distinct Favourable Blood Chemistry Profile Regardless of Age. Aging Cell;
  DOI: 10.1111/acel.70437
- In the research project MARK-AGE, a team of researchers from across Europe identified key markers for the biological ageing process. A total of 26 research teams at universities, national research centres and businesses in 14 European countries took part.
- For the project, researchers examined more than 3,300 volunteers. Study participants consisted of men and women between the ages of 35 and 74 from different regions of Europe.
- Project funding to the tune of 12 million euros was provided through the seventh framework programme of the European Community (FP7).
- Project coordinator: Professor Alexander Bürkle in the Department of Biology at the University of Konstanz


## Press release

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## Further information

- University of Konstanz