

Fast-forward Aging due to DNA Damage

In the course of time the DNA accumulates more and more damage – aging is one of the results. The manifold effects of DNA damage have now been shown in unprecedented complexity. The study by scientists led by Björn Schumacher at the Cluster of Excellence CECAD has now been published in the journal Cell Reports.

The heredity substance DNA is the blueprint of our life. Like an instruction manual it contains all the information needed for cells and the body to function properly. In the process, the DNA is always exposed to threats like UV light, pollutants and damage by metabolic byproducts. Many of those damages can be undone by sophisticated repair mechanisms. Nevertheless, the accumulation of DNA damage is a cause of aging. A team of scientists based at CECAD at the University of Cologne is now trying to better understand the damage to the genome driving the aging process.

For the study published in the journal Cell Reports, the researchers examined the nematode *Caenorhabditis elegans*. Because of its short life span of only twenty to thirty days, the worm is a popular model organism for aging research. When they exposed one-day-old worms to DNA damaging UV light, the team around Schumacher found that the young animals show surprising similarity to worms at old age. They compared comprehensively proteins, fatty acids, metabolism and signaling pathways. For Schumacher, the aha moment was when they found that the changes they knew to be occurring in old worms were now already unfolding in the young individuals within hours of inflicting the DNA damage. ‘Everything was there, nearly the complete picture of the aging process. That way, we could show that the aged individuals re-program their biological processes in reaction to the increased damage in their DNA. Fast-forward aging, in a matter of speaking’, says Schumacher.

In total, more than 5,000 different proteins and their connection via signaling pathways were examined: How are they connected, how are they interacting, do they regulate the same process? Like in a crossword puzzle, connections between metabolism, preservation of the DNA and proteins and signaling pathways determining the aging process became apparent. ‘In the end, we found all the strings and junctions – that was impressive and even better than expected. What was looming in other studies could be shown by us in the whole picture’, the researcher says.

Even though worm and human do not appear all that similar at first glance, their cellular processes are very similar and comparable. Many signalling pathways are identical, the metabolism alike, the quality control of proteins similar. That is what makes the worm so relevant for aging research. In the next step, the researchers want to take a closer look at the signalling pathways. The aim is to better understand the effects of DNA damage on the organism and to make healthy aging possible for humans.

Original publication:

Multilayered reprogramming in response to persistent DNA damage in *C. elegans*;

Diletta Edifizi, Hendrik Nolte, Vipin Babu, Laia Castells-Roca, Michael M. Mueller,
Susanne Brodesser, Marcus Krüger, Björn Schumacher
Cell Reports 20, 2026–2043 August 29, 2017

Contact:

Prof. Dr. Björn Schumacher

Principal Investigator, Chair for Genome Stability in Ageing and Disease
Tel. +49 221 478 84202
bjoern.schumacher[at]uni-koeln.de

Peter Kohl

Public Relations Officer
Tel. +49 221 478 84043
pkohl[at]uni-koeln.de

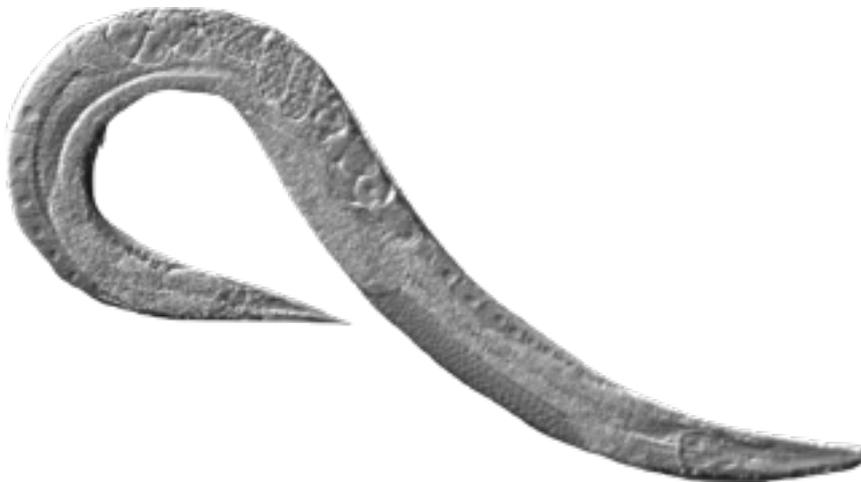


Image caption:

The nematode *C. elegans* is an important model organism for aging research. Even though it gets only one millimeter long and lives for three weeks, the same process are important in aging like in humans.