

## **Aging and Cancer: Identical Traces in the Genome**

**As we get older, the number of cancer-typical chemical changes in the genetic material of skin cells increases. This was shown by scientists of the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) and Beiersdorf AG research center.**

The upper cellular layers are getting thinner, production of firming collagen ceases, blood circulation is getting poorer. Sooner or later we all notice the effects of these changes when we look in the mirror: Aging skin gets lines and wrinkles. Many of the underlying cellular mechanisms are still unclear. Scientists in Professor Frank Lyko's team and from Beiersdorf AG research center had a suspicion: Chemical changes in the genetic material known as epigenetic modifications might contribute to skin aging.

"The skin is particularly exposed to environmental influences," Frank Lyko explains. "Epigenetic modifications are the key mechanism by which environmental factors act upon the genetic material and may contribute to signs of aging." In a study with volunteers, the scientists took two skin samples from every participant: one from the outside of the forearm and one from the inside of the upper arm, so as to be able to compare sun-exposed skin with light-protected skin. In the samples they analyzed a particularly well-studied epigenetic modification of DNA: the attachment of methyl groups. This chemical labeling is well known to cancer researchers, because it inactivates important growth brakes of cells. Therefore, methylation is regarded as a major cause of uncontrolled division of tumor cells.

In donors of the same age, the genetic material of skin cells showed almost identical methylation patterns. Comparison of the skin samples of younger (19-35 years) and older (65-71 years) donors revealed, however, that the number of methyl labels increases with growing age. The additional labels were not attached randomly, but rather to specific DNA positions. In aging skin cells the investigators found a very similar methylation pattern to that found in cancer precursors.

Comparison of sun-exposed and light-protected skin yielded a surprising result: Aging and sunlight seem to have contrary effects in the cell: Sunlight does not increase the number of methylations; it rather leads to slight but significant removal of the chemical labels. "At the moment we do not know how to assess this," says Frank Lyko. "By no means can we conclude from this that sunlight reactivates silenced growth brakes in the cell and thus counteracts aging and cancer." In a next step, the DKFZ researchers are planning to elucidate the actual effect of age-related and light-related changes in methylation patterns on carcinogenesis.

The scientists from Beiersdorf AG also gain important findings for their further research from the study. "Even in such a well-studied organ as the skin we still discover mechanisms and connections that have been completely unknown so far," says Horst Wenck, head of Beiersdorf's research department. "These results substantially increase our understanding of the ways in which environmental factors can influence skin aging." Wenck, a skin expert, is convinced that this knowledge will make it possible to develop even more effective products for skin care and skin protection in the future.

Elke Grönniger, Barbara Weber, Oliver Heil, Nils Peters, Franz Stäb, Horst Wenck, Bernhard Korn, Marc Winnefeld und Frank Lyko: Aging and chronic sun exposure cause distinct epigenetic changes in human skin. PLoS Genetics 2010, DOI:10.1371/journal.pgen.1000971

The German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) is the largest biomedical research institute in Germany and is a member of the Helmholtz Association of National Research Centers. More than 2,200 staff members, including 1000 scientists, are investigating the mechanisms of cancer and are working to identify cancer risk factors. They provide the foundations for developing novel approaches in the prevention, diagnosis, and treatment of cancer. In addition, the staff of the Cancer Information Service (KID) offers information about the widespread disease of cancer for patients, their families, and the general public. The Center is funded by the German Federal Ministry of Education and Research (90%) and the State of Baden-Württemberg (10%).

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