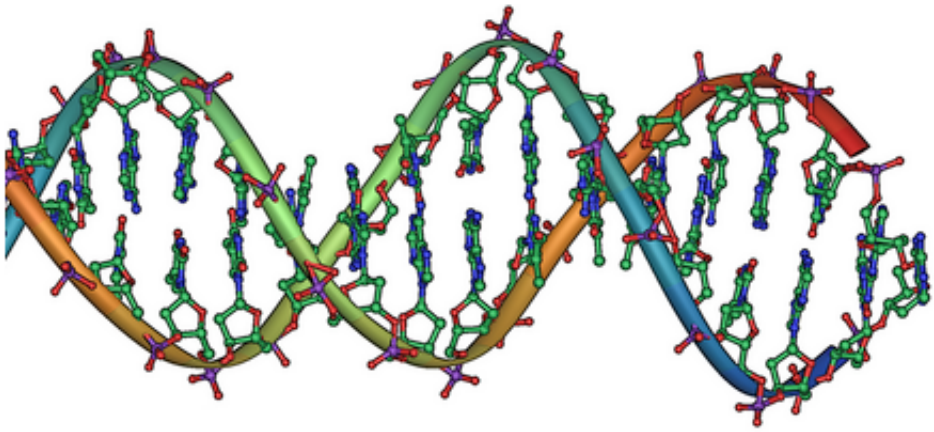
Dieting causes epigenetic changes during ageing

April 12 2017



DNA double helix. Credit: public domain

Reduced food consumption extends the lifespan of many organisms, including primates. The biology behind how this is achieved, however, is not yet fully understood. Researchers at the Max Planck Institute for Biology of Ageing and the Cluster of Excellence for Aging Research CECAD, Cologne, Germany, as well as the Babraham Institute in Cambridge have now found that in mice, dietary restriction triggers epigenetic changes in the DNAGenes, for example, which are important for the lipid metabolism, are switched off. Dietary restriction can thus

prevent the consequences of age-related changes in the so-called epigemome.

We are more than our genomes – the order of the letters (ATGC), known as bases, in our DNA. On top of this sequence is another layer of control – our epigenome – which, by a process of adding or removing tags to our DNA and by altering DNA packaging inside our cell nuclei, controls which genes are on or off in different cell types. Our epigenome is known to be influenced by external factors including diet, making it a prime candidate linking dietary restriction and longevity.

The researchers found that restricting the food intake of mice to 40 percent of their counterparts resulted in a 30 percent increase in lifespan. They looked across the whole mouse genome to profile the epigenetic changes to DNA occurring in response to this dietary restriction and which might explain the lifespan extension. They found that dietary restriction controlled genes involved in establishing one type of epigenetic change – the tagging of specific DNA bases with a small chemical group (called DNA methylation). The result was that age-related changes to DNA methylation across the genome were substantially prevented by dietary restriction.

Oliver Hahn, PhD Student in the Partridge Group at the Max Planck Institute for the Biology of Ageing and lead author of the study said: "Our research has identified physiologically meaningful epigenetic changes occurring during ageing. Dietary restriction partially protects against age-induced methylation changes whilst simultaneously instigating the reprogramming of lipid metabolism genes which seems to result in beneficial changes to which help our bodies function better".

In addition to profiling the effects of dietary restriction on age-related changes to DNA methylation, the researchers also discovered a link between dietary restriction and the epigenetic repression of genes

involved in lipid metabolism. Physiologically, the reprogramming of lipid metabolism caused by dietary restriction protected organisms against age-related increases of fat deposits in the liver and the development of hepatic insulin resistance, a feature of age-related type 2 diabetes.

Wolf Reik, Head of the Epigenetics programme at the Babraham Institute, explained: "This work significantly advances our understanding of epigenetic regulation of ageing and dietary restriction by connecting the epigenome more directly with lipid changes associated with healthy ageing. Future work may reveal if dietary restriction leaves a long term epigenetic memory in the genome."

More information: Oliver Hahn et al. Dietary restriction protects from age-associated DNA methylation and induces epigenetic reprogramming of lipid metabolism, *Genome Biology* (2017). DOI: 10.1186/s13059-017-1187-1

Provided by Max Planck Society