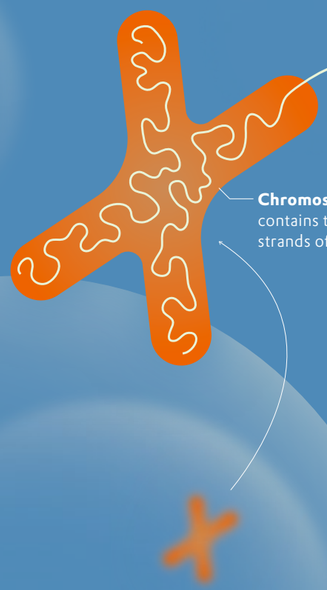
Regulating life

Classical genetics explains how genetic material is transmitted from one generation to the next. However, the environment also has a demonstrable influence on genetic information. Methyl groups that activate or repress individual genes play an important role in these epigenetic mechanisms

INFOGRAPHIC **MAXIMILIAN NERTINGER**

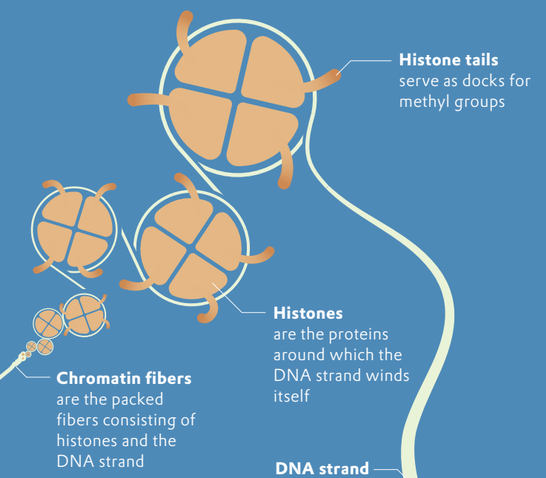
GENOME

The genetic information of an organism is stored in the cell nuclei of its body. In human beings, the DNA (desoxyribonucleic acid) is distributed among 46 chromosomes, which are X-shaped structures made of coiled strands of DNA.



Chromosome
contains the coiled strands of DNA

Nucleus
of the cell



Histone tails
serve as docks for methyl groups

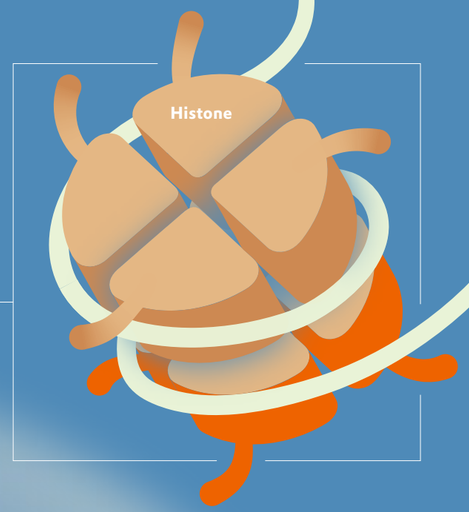
Histones
are the proteins around which the DNA strand winds itself

Chromatin fibers
are the packed fibers consisting of histones and the DNA strand

DNA strand

HISTONES

To ensure that the DNA strand does not get tangled up inside the chromosome, it is wound around spools called histones.
Eight histones in combination with the DNA strand form a nucleosome.

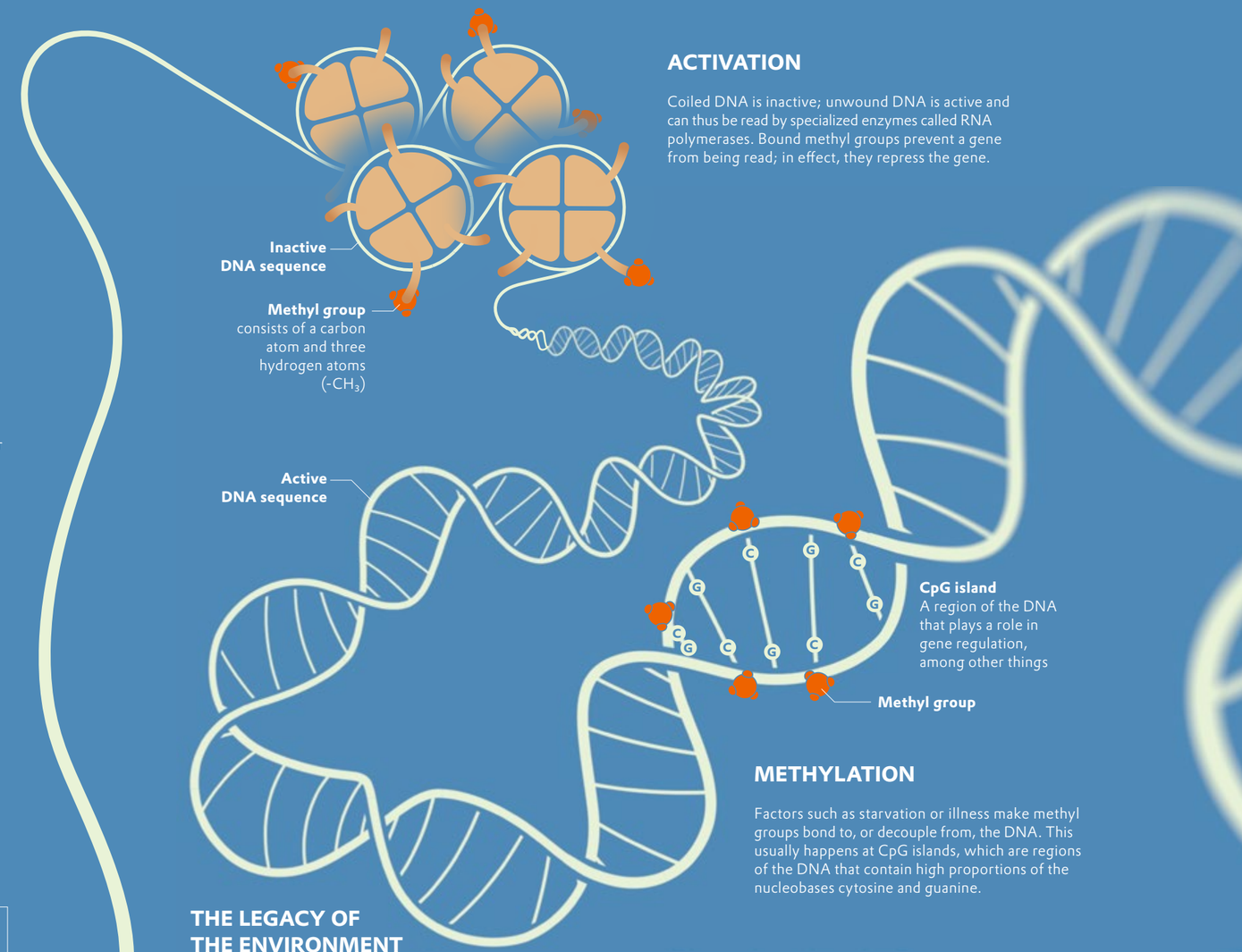


Nucleosome

Stem cells
Cells that undergo a process of division to generate a copy of themselves as well as specialized cells such as muscle cells

ACTIVATION

Coiled DNA is inactive; unwound DNA is active and can thus be read by specialized enzymes called RNA polymerases. Bound methyl groups prevent a gene from being read; in effect, they repress the gene.



METHYLATION

Factors such as starvation or illness make methyl groups bond to, or decouple from, the DNA. This usually happens at CpG islands, which are regions of the DNA that contain high proportions of the nucleobases cytosine and guanine.

THE LEGACY OF THE ENVIRONMENT

Depending on living conditions as well as the number and distribution of the methyl groups, a very characteristic methylation pattern—the epigenome or methylome—is generated. From this pattern, epigeneticists derive precise information about an organism's biological age, health condition or origin.

The epigenetic imprinting can be transferred to the organism's descendants. If human beings suffer from starvation and their bodies therefore metabolize food with particular efficiency, their following generations may have an increased rate of obesity. This was documented for the descendants of women who had suffered through the "Dutch winter of starvation" in 1944.