

# Gene on, gene off

Environmental influences can activate genes. However, there are no detection methods as yet. A research team at the BfR wants to change this.

Does our lifestyle change our genes? Are they influenced by ingredients in food, cosmetics, textiles or packaging? Clarifying this question would be a milestone in health risk assessment. This will require test methods to identify what are known as epigenetically active substances. They can switch on deactivated genes or put activated genes into sleep mode. Dr Josephine Kugler is investigating detection methods at the German Federal Institute for Risk Assessment (BfR). The biochemist wants to develop molecular, animal-free tools that can detect cell changes caused by epigenetically active substances.

## FOLDED, PACKAGED AND COILED

Each of our cells contains two metre-long DNA strands with different base sequences that are tightly folded and coiled in a tiny space. The genes' coiling determines the cell type, i.e. heart, skin or nerve cell, and also influences the behaviour of the cells, such as the division rate. "Some genes are packaged so well by this coiling and the closely aligned DNA sequences that they are inaccessible and inactive," explains Kugler.

The DNA strands are coiled around histones. These are proteins that package the DNA in the cells. "Histones have small rods that stick out of the coiled DNA, like clips on hair curlers," explains Kugler. Substances from the environment or hormones that are released due to anxiety or happiness can stimulate or change the histone rods and activate or deactivate the packaged genes. "Two people can therefore have the same cancer gene, but it could be that only one of them actually develops cancer."

Dr Josephine Kugler works on epigenetically active substances at the BfR.



Kugler and her team work with cultured human breast cancer cells to detect the epigenetic effects of substances. These work well because they grow quickly. Students from the "Life Science" department of the Berlin University of Applied Sciences are also providing support as part of a cooperation agreement. The team is simulating the processes triggered by epigenetically active substances in the laboratory to develop a test method. The breast cancer cells are labelled with easily detectable epigenetic markers. Then they wait. Changes in the histones can only be observed under the microscope after several hours. With plenty of patience, the researchers are laying the foundations for a test procedure that could make an important contribution to the risk assessment of chemicals in the future. —

## EPIGENETICS

Epigenetics is a young field of research in molecular biology. The prefix "epi" comes from the Greek and means "over". Epigenetics deals with the mechanisms that control the accessibility of genes and ultimately their activity. It is assumed that the state of our genes changes over our lifetime. Both activated and deactivated genes can contribute to the onset of diseases. This would also explain why identical twins with identical genes can develop different diseases over their lifetimes.