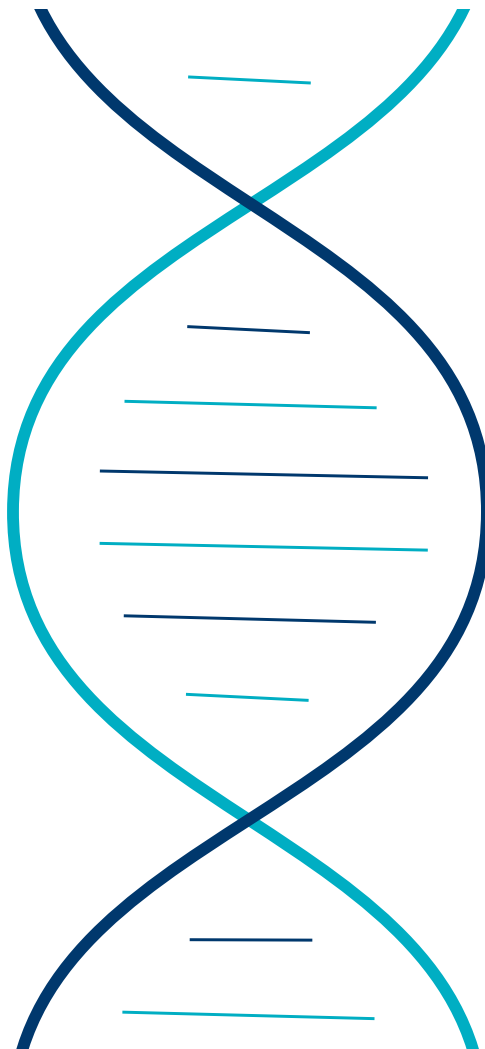




GENE CUTTING



New bio-
technological
methods
allow precise
interventions in
genetic material
– how well can
changes be
detected?

No plant breeding without mutation. Mutagenesis – the creation of genetic changes – is the beginning of new fruit and vegetable varieties, of higher-yield maize or tastier apples. In conventional breeding, plants are irradiated or chemically treated to accelerate the occurrence of mutations. It has become possible to change genetic material in a targeted way with the development of plant biotechnology. Accident becomes intention.

New methods such as the CRISPR/Cas9 “gene scissors” now allow the smallest of interventions. The result is indistinguishable from natural mutations; in a sense, nano-surgery on the genetic information of wheat, rapeseed, etc. Is public opinion changing?

Hermann Broll is not willing to give a statement, no matter how much we would like to know. The biologist at the German Federal Institute for Risk Assessment (BfR) keeps his distance from all opinions and intentions in this field and concentrates solely on the scientific facts. Broll is an expert in genetic analyses. He was involved at an early stage in work on how to detect genetic information from genetically modified organisms (GMOs) in food and feed.

FAST COPIER FOR GENETIC MATERIAL

“The methods established by my colleagues and I at the BfR’s predecessor – the German Federal Institute for Consumer Health Protection and Veterinary Medicine – were the first standard worldwide,” Broll recalls. They are based on the polymerase chain reaction (PCR). PCR is a kind of fast copier for DNA genetic information. It makes it possible to detect

even the smallest traces of a specific genetic material sequence in food.

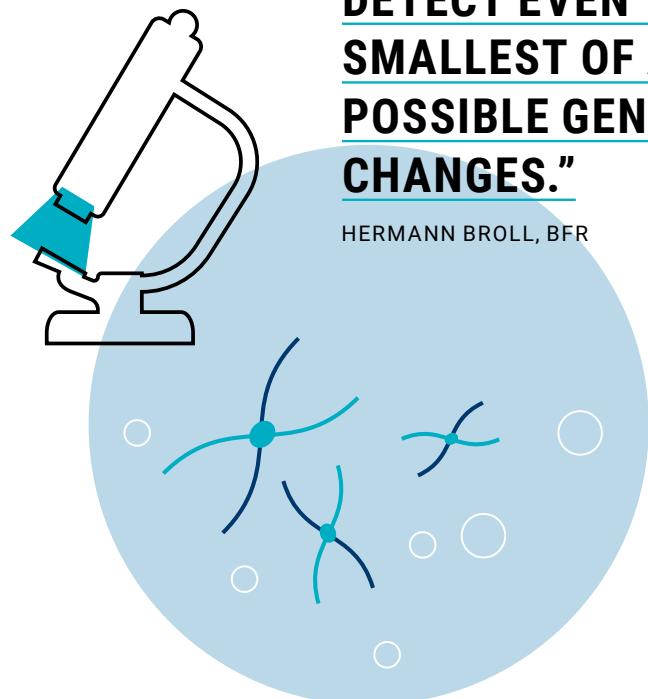
In 2008, Hermann Broll organised the first major international conference on the detection of GMOs together with the European Commission’s Joint Research Centre (EC-JRC). A lot has happened since then. New methods like gene scissors have revolutionised biotechnology, new analytical methods make it possible to decipher entire genomes (the complete genetic information) and make it easier to detect GMOs. Reason enough for Broll to bring the scientific community together again: in March 2023, almost 500 participants from 55 countries met in Berlin for a conference on GMO analysis and new genomic techniques.

EVEN THE SMALLEST CHANGES DETECTABLE

An important topic of discussion were GMOs, in which only a single base in the genetic information DNA is replaced using gene scissors. This corresponds to one letter in a book with tens of thousands of pages. The technical term for this is point mutation. “In principle, it is possible to detect even this smallest of all possible genetic changes,” says Broll. “However, most conference participants agreed that it is not yet possible to determine who caused this change, in other words, how the change came about.” Whether of natural or artificial origin, intentional or accidental – the mutation does not reveal its origin.

“IN PRINCIPLE, IT IS POSSIBLE TO DETECT EVEN THE SMALLEST OF ALL POSSIBLE GENETIC CHANGES.”

HERMANN BROLL, BFR



Are gene scissors (which are also expanding into medicine) and other “new genomic techniques” still genetic engineering in the conventional sense? In 2018, the European Court of Justice ruled that plants and animals modified using new genomic techniques are GMOs. However, this did not put an end to the discussion, which has only really just begun. For example, how risky are genetically modified plants, where the genetic



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material cannot be distinguished from that of conventional breeds? What about being labelled “genetically modified”, what about traceability?

DISCUSSION ABOUT EASING RESTRICTIONS

With this in mind, the European Commission is making efforts to rethink the current legal situation and adapt it to the new methods. The intention is to ease the current restrictions for plants that have been produced using new genomic techniques, such as CRISPR/Cas9, and that only contain genetic material that is also present in the species’ current gene pool. This affects things such as labelling as “genetic engineering” and the approval procedure. Whether or not EU will follow the suggestions is still unknown (as of September 2023).

Hermann Broll also mentions a second result of the Berlin conference that has very practical significance: “It has once again become clear how big the differences are in the laboratories. Europe and North America are well equipped for detecting GMOs, whereas this is often not the case in Asia and Africa.” From Broll’s perspective, this needs to be remedied. For example, if an African country wants to export “genetically modified-free food” to Europe, it must be able to prove this. This also means that European decisions on plant biotechnology reach far beyond the continent. Even if it does only concern point mutations. —

More information



Broll, H. et al. 2019. **European Court of Justice decision for genome editing: Consequences on food/feed risk assessment and detection.** Food Control, Volume 104, 288-291, DOI: 10.1016/j.foodcont.2019.05.002



Video recordings of the talks **International Conference on GMO Analysis and New Genomic Techniques 2023**