Website address:
https://www.biooekonomie-bw.de/en/articles/pm/green-genetic-engineering-making-mendels-dream-come-true-molecular-scissors

Green Genetic Engineering: Making Mendel's Dream Come True with Molecular Scissors

Molecular biologist Professor Holger Puchta from Karlsruhe Institute of Technology (KIT) is granted funding within a Reinhart Koselleck Project by the German Research Foundation (DFG) for work on specific restructuring of plant genomes. Puchta, a pioneer of green genetic engineering, has used molecular scissors in plants for 30 years now. His new project is aimed at using the CRISPR/Cas method to freely combine genes in crops, thus making Gregor Mendel's dream come true. This will also be important to better adapt agricultural crops to global warming in future.

The founder of genetics, Gregor Mendel (1822 – 1884), believed that all traits of plants can be combined freely with each other. Now, it is known that certain traits are inherited jointly, because the genes encoding them are located on the same chromosome. With the modern CRISPR/Cas molecular scissors, however, genetic information in plants can be modified specifically. The group of Holger Puchta, Professor for Molecular Biology at KIT's Joseph Gottlieb Kölreuter Institut of Plant Sciences (JKIP), was the first to recently demonstrate that not only single genes, but entire chromosomes can be modified this way. To establish technologies for the specific restructuring of plant genomes, Puchta is now granted funding within a Reinhart Koselleck Project by DFG. The project aims to freely combine genes in crops and to make Gregor Mendel's dream come true.

"Holger Puchta's work is path-breaking and contributes to sustainable agriculture," says KIT's Vice President Research, Professor Oliver Kraft. "We are very proud of Puchta being one of the first plant scientists, who are granted the rare Reinhart Koselleck Project after he has received two Advanced Grants of the European Research Council ERC already."

Reinhard Koselleck Project Aims to Specifically Optimize Crops

Under the present conditions of global warming, existing crops need more land, more water, and more fertilization. "The molecular scissors can modify plants such that they can better cope with the heat. Moreover, the CRISPR/Cas method can make plants more resistant to diseases and pests. This will reduce the need for pesticides," Puchta explains. CRISPR/Cas stands for a certain segment on the DNA (CRISPR - Clustered Regularly Interspaced Short Palindromic Repeats) and an enzyme (Cas) that recognizes this segment and cuts the DNA precisely. With this method, certain single traits of crops have already been improved. The Reinhart Koselleck Project of Holger Puchta will further exhaust the potentials of the method and aims to specifically restructure plant genomes on various levels. By modifying the arrangement of genes on chromosomes, the molecular scissors can freely combine plant traits. "In this way, crops can inherit several desired properties in combination, such as heat and salt resistance," Puchta explains. In the long term, it will become easier for plant growers to use the entire gene pool of a species and to specifically optimize crops.

The project is scheduled for a duration of five years and is funded with a total of EUR 1.22 million. Reinhart Koselleck Projects are DFG's highest excellence funds granted to persons. Funding enables outstanding researchers with a proven scientific track record to pursue exceptionally innovative or high-risk projects.

Gene Scissors Can Accelerate the Process of Natural Modifications in the Genome

Puchta welcomes that the EU Commission intends to establish new rules to govern the use of genome editing methods, such as CRISPR/Cas, in plant cultivation. According to a recently presented legislative proposal, it is planned to treat new plant species produced with the help of genome editing equal with conventionally grown plants under certain conditions. "From the scientific perspective, this is sensible, as no foreign genetic material is introduced by genome editing," the molecular biologist says. "Instead, specific and limited modifications are made. Gene scissors, such as CRISPR/Cas, can accelerate the slow process of natural modifications in the genome, which opens up great opportunities especially under the current conditions of climate change."

Press release

25-Jul-2023
Source: Karlsruhe Institute of Technology (KIT)

Further information

- Karlsruhe Institute of Technology (KIT)