# New methods of genetic engineering and the 'poisonous CRISPR mushroom'

Testbiotech to release a video clip showing a possible future scenario

18 July 2018 / Today Testbiotech is releasing a video clip about the first mushroom to be created through having its genome manipulated by CRISPR-Cas. It is worldwide the first CRISPR organism to be approved for use in food production: US authorities gave their go-ahead in 2016. Because no additional genes were inserted, the regulatory authorities did not request a detailed risk assessment. As yet, the mushroom is not available on the market.

The video clip aims to highlight an ongoing highly dynamic process in the field of genetic engineering. New tools such as the 'DNA scissor' (nuclease) CRISPR-Cas have become cheaper and more efficient than previous methods. This means that many more plants and animals can be genetically engineered within shorter periods of times than has been the case until now. The technical potential of genome editing goes far beyond what has ever been achieved with previous methods of genetic engineering: radical changes in the genome and the usage of synthetic DNA with no natural template has become reality. Some of these genetic changes are said to be to be very small and precise. The video clip is about such 'small' and targeted genomic changes where no additional DNA sequences are inserted.

The specific mushroom presented in our video clip was manipulated with CRISPR so that it does not turn brown after being cut or during storage, and consequently it looks fresher than it actually is. For this purpose, several copies of one specific gene were deleted in the genome. This gene is necessary to produce an enzyme, which is involved in browning and that is part of the natural degradation process of mushrooms. Thus, although no additional genes were inserted, several copies of one natural gene were destroyed.

The video shows that even if no additional genes are inserted, there are substantial differences between conventional breeding and genome editing. Some reasons: the application of nucleases, such as CRISPR-Cas, is not subject to natural control mechanisms of gene regulation and heredity to the same extent as conventional breeding. The DNA scissors can also change genetic conditions in ways that would not be expected under natural conditions. Furthermore, unlike conventional breeding, genome editing always changes all the copies of a gene at the same time. Whereas conventional breeding usually means that there are still some backup copies present in the genome that can compensate the effects of random mutations.

As a result, with genome editing there is in most cases a very specific pattern of change in the genome. This means that plants and other organisms can be created with changes not only in their genetic structure, but with unintended biological effects and risks that are clearly different to conventionally breeding.

The story told in the video is of people falling ill from eating the mushrooms, especially with diarrhoea. The effects on the health of particularly vulnerable groups in the population (children and the elderly) are shown to be severe. The scenario starts with a simple observation: the browning of the mushrooms has something to do with the processes of its natural degradation. These processes can also be involved in their digestibility. If this enzyme is blocked, it might also have implications for nutritional quality. Conclusion: in the case of the CRISPR mushroom, it would be necessary to examine whether the metabolism in the mushroom was changed unintentionally. The risk assessment cannot be confined to the level of DNA and the question of whether genes are inserted or not. The composition of the mushroom components also has to be investigated. However, no such investigations were carried out in the US, so it is not possible to draw any conclusions on their

safety.

Therefore, the future scenario proposed in the video cannot be ruled out. How probable it really is, nobody can say. And this is precisely the problem. For this reason, Testbiotech is strongly calling for these plants to be subjected to mandatory risk assessment before a decision is made on agricultural usage or release into the environment.

On the other side, industry as well as various users and developers of the technology want to exclude plants and animals with so-called 'small' changes in their genome so that they do not have to undergo an approval process, and are not subject to mandatory risk assessment if no additional genes are inserted.

Currently, if no approval process is required, the companies do not need to present any data on risk assessment. Consequently, independent experts will not be able to examine the risks in detail. Furthermore, if labelling is not required, consumers will no longer have any choice.

Further information:
www.testbiotech.org/en/limits-to-biotech/mushroom/basic_paper [1]
www.testbiotech.org/en/limits-to-biotech/what-is-genetic-engineering [2]
www.testbiotech.org/en/node/2198 [3]

**Further information:** The video clip [4]
Questions and answers about the video [5]



**Links**
[1] http://www.testbiotech.org/en/limits-to-biotech/mushroom/basic_paper [2] http://www.testbiotech.org/en/limits-to-biotech/what-is-genetic-engineering [3] http://www.testbiotech.org/en/node/2198 [4] http://www.youtube.com/watch?v=i7QP_j6gx4Y [5] http://www.testbiotech.org/node/2238