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Ethics Council: Eradicate disease vectors and agricultural pests with gene drives?

"Gene drive – Turbo inheritance in medicine and agriculture" – this was the title of the public autumn conference held by the German Ethics Council in Frankfurt am Main on 26 October 2017.

Gene drives are molecular mechanisms that rapidly spread genetic traits within a population. When combined with new genome editing techniques like CRISPR-Cas9, they can develop a very substantial impact. Because of the quick succession of generations, current research mainly focusses on gene drive interventions in insects. Gene drives are considered, for instance, for the control of mosquito populations that transmit diseases like malaria. These opportunities are, however, juxtaposed with ecological risks of uncertain magnitude, and other legal and ethical concerns which need to be weighed up in societal discourse.

The Ethics Council has put gene drives on its agenda "because, up to now, this topic has not yet penetrated the awareness of the general public and, so far, no precedents have been set", stressed Peter Dabrock, Chair of the German Ethics Council, in his welcome address. It was important to raise uncomfortable questions, commented Dabrock, and to work towards a policy that took adequate account of the environment, in addition to various social concerns.

The geneticist Nikolai Windbichler who outlined the basic molecular principles of the subject, sees gene drives as a species-specific and effective genetic technology that could, for example, considerably reduce the size of mosquito populations or modify the insects in such a way that they no longer transmit diseases like malaria. Contrary to some fears Windbichler explained that the technology "is neither permanent nor unstoppable". Mosquitoes can develop resistances to gene drives, too, similar to the resistances to malaria medication. Furthermore, research is ongoing on ways of neutralising gene drives if this should prove necessary.

For Marc F. Schetelig, specialist for insect biotechnology in plant protection, genetic strategies for pest management are a viable alternative to insecticides for pest control. Gene drive applications in the agricultural sector promised major benefits for farmers and large sections of the population. However, given the lack of field studies it was not yet possible to quantify them.

The biologist and technology assessment expert Arnim von Gleich began by pointing out that, in the case of gene drives, it was still too early to talk about opportunities and risks. At the present time, it was only possible to judge the promised benefits and the grounds for concern. In terms of depth of intervention, a prospective technology impact assessment would have to encompass a characterisation of the technology, a vulnerability analysis of the

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target technology and of the systems that are interfered with as well as an analysis of the goals and contexts of any application.

In her presentation the cultural scientist Julia Diekämper addressed why it was necessary to involve the public in the relevant negotiation processes. Diekämper commented that it was not about securing their acceptance but rather about giving them platforms to articulate not only rational contributions but also often intuitive, judgmental and emotional opinions. She stressed the importance of discussing any such contributions seriously, since gene drive technologies would have an impact on the daily life of each and every one of us.

The biologist and environmental ethicist Uta Eser expressed doubts whether the fight against hunger and infectious diseases justified the deliberate eradication of entire species. Even if gene drives were deemed to be an appropriate and permissible means of achieving a legitimate end, the eudaimonistic question would remain as to whether their use was desirable. According to Eser there were definitely sound arguments for viewing the deliberate eradication of species by gene drive with caution.

The agricultural economist Justus Wesseler performed a cost-benefit analysis of gene drive technology. He considered the application, research, development and follow-up costs in the light of both the opportunities for containing diseases in humans, animals and plants and the risks from a conservation perspective. The eradication of disease vectors, like the malaria mosquito, might be easier to achieve biologically through gene drive than the control of malaria transmission. However, it had to be borne in mind that this could result in ecological costs that would be difficult to calculate.

The international law expert Silja Vöneky looked at the loopholes in existing regulations in national, European and international law. She recommended supplementing international standards in order to put in place legal boundaries for gene drive experiments and their applications.

The final panel discussion chaired by the legal expert and Council member Steffen Augsberg, looked at appropriate governance strategies. Malaria researcher and Vice-President of the German Research Foundation Katja Becker, WHO representative Mathieu Bangert, veterinarian Christoph Then and biochemist Joachim Schiemann all basically agreed that the public had to be included in societal discourse and international regulatory approaches had to be pursued. Furthermore, interdisciplinary research on gene drives should be continued. In this context, the precautionary principle calling above all for the option of intervention in the event that something went wrong, was the overriding maxim.

Audio recordings of the presentations at the autumn conference can be accessed on http://www.ethikrat.org/veranstaltungen/weitere-veranstaltungen/gene-drive and print versions will be available, too (in German).