

'Indirect' genetic engineering of honey bees

Patent application covers genetically engineered bacteria and bees

9 July 2020 / US researchers have filed an application for a patent covering genetically engineered bacteria, including the bees that have the microbes in their gut. According to the patent application, the bacteria can produce molecules which interfere with gene regulation across species boundaries. That way the honey bees are 'indirectly' genetically engineered. These molecules are, for example, intended to target bee behaviour and thus enhance pollination effectiveness. Other purposes are to kill parasites, such as Varroa mites or rapid degradation of pesticides to which the bees are exposed.

Researchers at the University of Texas at Austin engineered the genome of bacteria found in the gut of bees and bumble bees to make them produce additional biologically active molecules (double stranded ribonucleic acid, dsRNA). The molecules are meant to be taken up from the gut and thereby spread to other parts of the bee, including their central nervous system. According to the US application (US 2019 / 0015528 A1), the patent not only claims the bacteria as an invention, but also the honey bees and all other insects in whose gut these genetically engineered bacteria are found.

It would be particularly problematic if bees with such microbes were to be released since there is no way of preventing the bacteria from infecting the gut of other honey bee colonies or wild relatives, such as bumble bees. Moreover, their synthetic genes can also be transferred to other species of bacteria. This problem not only raises questions in regard to the scope of the patent but also triggers incalculable environmental risks: once released, the spread of the organisms and their synthetic genes could not be efficiently controlled.

In this context, the most relevant gut bacteria are *Snodgrassella alvi*. These microbes were only discovered a few years ago and are found in honey bees as well as in bumble bees. The bacteria play an important role in the vitality and the immune system of the bees. Changes in the populations of *Snodgrassella alvi* are known to substantially weaken the health of bee populations.

The patent is just one example of several projects aiming to turn genetically engineered microorganisms into a new and profitable playing field. This is, however, associated with a high degree of risk for the environment. Especially so-called "paratransgenesis" is becoming increasingly important: instead of directly manipulating the target organisms (such as honey bees), their associated microbiomes, e.g. intestinal bacteria, are being genetically engineered. As a result, these microbes can produce biologically active substances able to change the biological characteristics of their 'hosts'. These complex interactions will create a whole new dimension of environmental risk.

Further information: [US patent application \(US 2019 / 0015528 A1\)](#) [1]
[Leonard et al. \(2020\) Engineered symbionts activate honey bee immunity and limit pathogens. Science, 367: 573-576.](#) [2]
[Testbiotech report on genetic engineering and species protection](#) [3]
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