What is the value of this knowledge?

- **Strengthening the immune system:** compounds produced by micro-organisms to manipulate the plant's immune system could help vines maintain their immunity under climate stress.
- **Harnessing microbial competition:** Substances produced by microorganisms to knock out their competitors could be used to arm plants. Example: O-methylmellein could improve the defence against bacterial diseases of the grapevine such as mallenders, Pierce's disease or *flavescence dorée*.
- **Optimisation of the plant "intestinal flora":** The formation of the surrender signal ferulic acid could be suppressed through the targeted establishment of a "healthy" microflora in the root zone, so that the vine remains healthy even under climate stress.

Contakt

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DialogProTec

Good chemical communication promotes healthy vines

- Climate change is increasingly affecting agriculture in the Upper Rhine region. New diseases are spreading - in viticulture in particular Esca & Co, which cause immense damage.
- The triggers are fungi that actually live as harmless co-consumers in the wood. If they notice that their host is weakened by drought and heat stress, they produce toxins, kill their host and look for a new host. Disease is therefore a disturbed chemical communication between plant and fungus.
- We have identified some of the signals that make the difference between illness and health. With this, we can bring chemical communication back into balance, even under climate stress.

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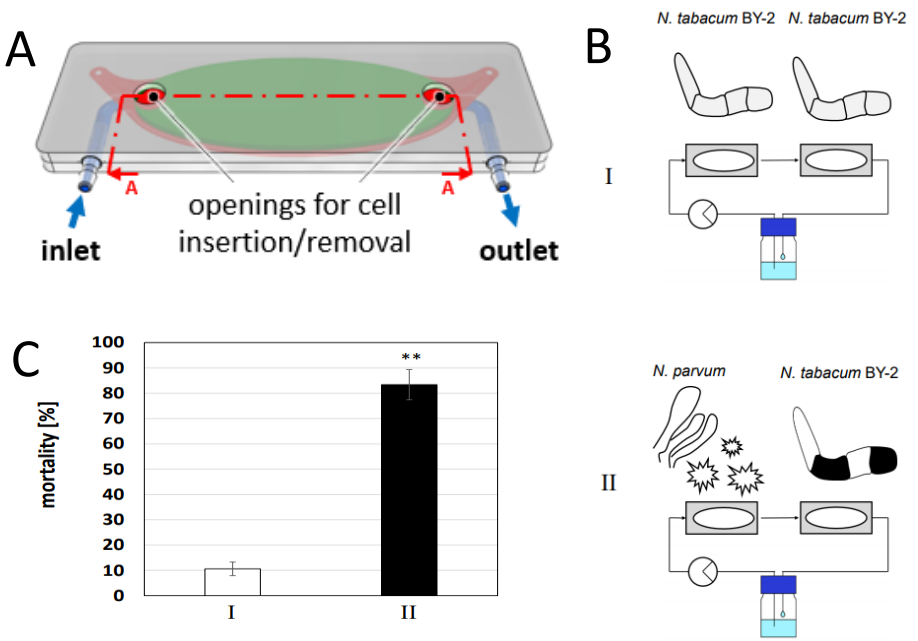
Der Oberrhein wächst zusammen: mit jedem Projekt Dépasser les frontières, projet après projet

An „Ecosystem on a chip“

In order to be able to study the communication between plants and fungi, we have developed an "ecosystem on a chip" so that the cells of different organisms can communicate chemically but without contact. This enabled us to prove that the fungus *Neofusicoccum parvum* secretes a substance that causes plant cells to die (**Fig. 1**).



How the experiment works: **Fig. 1A** illustrates the structure of the chip, the cells grow in a chamber that is supplied with nutrient medium via a membrane (green). In **Fig. 1B** you can see the experimental setup - if you combine two chambers with plant cells (tobacco BY-2 cells, top), the cells feel at ease. If hyphae of N. parvum are introduced into the upper chamber (bottom), the plant cells in the lower chamber die. The fungal toxin is very effective and kills over 80% of the plant cells (**Fig. 1C**).Translated with www.DeepL.com/Translator (free version)

Which signals do we already know?

In the healthy plant, the fungus living in the wood triggers a mild immune reaction of the plant, which leads to the formation of the defence substance resveratrol. The fungus, on the other hand, mimics the plant hormone auxin via 4-hydroxyacetic acid, which enables it to moderate the immune reaction to such an extent that it does not become too dangerous for it. If the plant is subjected to prolonged drought and heat stress, which is becoming more and more frequent in our region as a result of climate change, ferulic acid accumulates. This precursor of woody material (lignin) is actually immediately incorporated in the healthy plant - ferulic acid signals to the fungus that its host plant is no longer doing well and that it is therefore time to look for a new host. It now forms fusicoccin A, which triggers a suicide reaction in the plant. The fungus now helps itself to the dead plant cells, uses the energy for sex and "takes off" (it forms fruiting bodies that burst out of the wood). In addition, we were able to show that the fungus Eutypa lata induces the grapevine to attack competing bacteria via O-methylmellein.