DialogProTec in Numbers

- project duration: from 01/07/2019 til30/06/2022
- total project costs 999 660 €, of which 499 830 € ERDF funding

Project Website

More information and news at **www.dialogprotec.eu**

Project Partners

- Karlsruhe Institute of Technology (KIT) – Botanical Institute (lead partner) and Institute for Microstructure Technology
- University of Freiburg – Institut für Pharmazeutische Wissenschaften
- University of Strasbourg – Institut de Biologie Moléculaire des Plantes
- Institute of Biotechnoloy and Drug Research (IBWF)
- Research Institute of Organic Agriculture (FiBL)

Contact

Prof. Dr. Peter Nick
Molekular Cell Biology, Botanical Institute,
Karlsruhe Institutw of Technology (KIT)
peter.nick@kit.edu

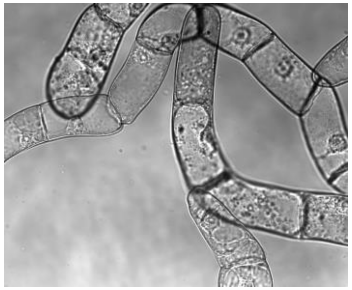
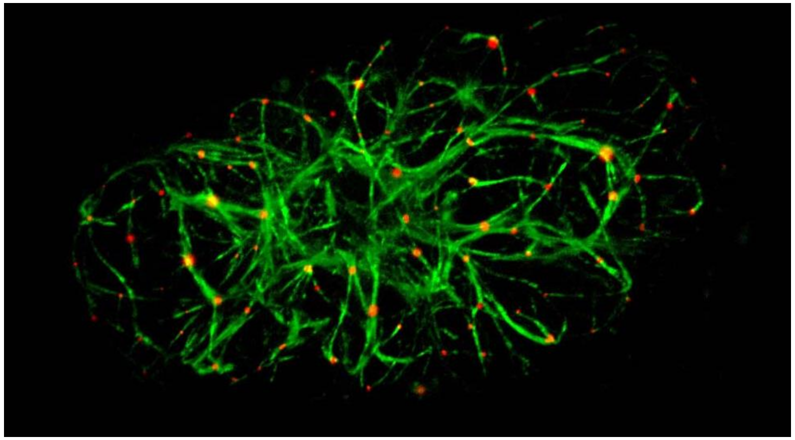


Fig. Plant cells

Impressum: Prof. Dr. Peter Nick, Molekulare Zellbiologie, Botanisches Institut, Karlsruher Institut für Technologie (KIT); **Bilder**: KIT-BOT & IMT



DialogProTec

Chemical dialogue as protective technology in sustainable crop protection

- With globalisation and climate change, new plant diseases are spreading in the Upper Rhine region. At the same time, consumers and society are demanding sustainable, resource-conserving agriculture.
- New approaches are needed: instead of poisoning harmful fungi and weeds with fungicides or herbicides, we want to use chemical communication between host and pathogen.
- Our goal is to use a biochip process to identify these communication signals which can be used to develop strategies for chemical crop protection without side effects.

Fonds européen de développement régional (FEDER)
Europäischer Fonds für regionale Entwicklung (EFRE)

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Transcending borders, with every project.

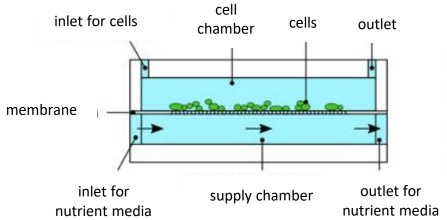
Our challenge

Climate change brings new challenges for agriculture, also in our region on the Upper Rhine. For example, drought and heat are creating new disease patterns, such as Esca syndrome in viticulture. But our plant world is not only suffering in the fields: neophytic weeds are displacing our native plants and trees in our towns and forests are being attacked by parasitic fungi. Some have immigrated as a result of globalisation, others have always been here. When their host suffers from climate stress, they turn from harmless roommates into vicious killers. We are looking for new ways to protect our plants: instead of poisoning harmful fungi and weeds with fungicides or herbicides, we want to use chemical communication. Nature has produced numerous chemical signals to control or infiltrate the interaction between organisms.

Identifying and harnessing chemical communication

In order to identify such signals and make them usable, we have assembled a network of many disciplines in which plant sciences, fungal genetics, chip technology, organic chemistry and agricultural sciences work together. With the help of an "ecosystem on a chip" we will search natural biodiversity for new active ingredients to find new ways of protecting crops that are sustainable because they are rooted in biological evolution.

Ecosystem on a chip for sustainable plant protection



At KIT, the Institute of Microstructure Technology in cooperation with the Botanical Institute has developed a microfluidic bioreactor in which plant cells can be cultivated. Its modular design allows to connect different cell types with each other by a common metabolic flow and thus to generate new substances or to increase efficiency, if necessary.
The microfluidic bioreactor consists of two chambers separated by a permeable polymer membrane, which is permeable for metabolic products and nutrients. In the upper chamber the plant cells are cultivated, through the lower chamber the supply current flows.

Our research topics

1. Biodiversity of fungi and plants
If you want to find something, you must first have something to look for. The partners IBWF and KIT-BOT provide collections of more than 20000 fungal strains and 6000 plant species that are tested for signaling substances.

2. Chip Technology
Since investigations of chemical communication on whole plants would be very complex, we work with cells of plants and fungi. These cells communicate chemically without touching each other on a microfluidic chip developed by the project partners KIT-IMT and KIT-BOT.

3. Readout system for plant immunity
In order to find signals with which plant immunity can be activated (a kind of "vaccination for plants") we have to test many signals and combinations. To do this, we use a selection system based on a gene switch found by KIT-BOT from a European wild vine with a particularly strong immune system. We place this gene switch in front of a gene coding for the green fluorescent protein and introduce the whole thing into the genome of our test cells. Whenever a signal activates the immune system, we can then measure a green glow.

4. Read out system for growth control
We hope to find signals that can be used to inhibit plant growth or perhaps even increase it in order to develop bioherbicides or growth promoters. We are using seedlings of the model plant thale cress (Arabidopsis thaliana), which are so small that they can be integrated into a chip. Here, the University of Strasbourg has also developed selection systems based on the green fluorescent protein, in which the so-called cytoskeleton can be observed, an important regulator of growth.

5. Identification of the chemical structure and synthesis of the signal
Once an interesting activity (immune activation or growth control) has been found, the next step is to find and clarify the molecule responsible. This is done by activity-guided fractionation where the solution is divided into fractions according to chemical properties and it is checked which fraction is responsible for the effect. This fraction is then further separated until the effect is narrowed down to a few candidate molecules, which are then identified at the University of Freiburg. Then, in cooperation with partner IBWF, they are produced in larger quantities from the fungi so that their mode of action can be investigated in greater detail.

6. Analysis of the mode of action
In order to find new ways to protect crops, it is important that we test the effects of our new candidates under realistic conditions. The Research Institute of Organic Agriculture supports us here as a Swiss partner with trials at various levels from the laboratory to the field.