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Active Substances from Plant Cell Cultures

Christian Brunold, Yury Y. Gleba, Lutz Nover, J. David Phillipson, Elmar W. Weiler, Meinhart H. Zenk

Drugs and substances for environmental remediation can be extracted from plant cell cultures. With this biotech method it is possible to utilize the wide variety of natural active substances without endangering the wild plant population.

Individual plant cells are isolated from the cell layer and kept in a culture medium. The procedure allows the breeding of any number of plants of the same type. (Photo: Peter Allert)

Whether used against harmless complaints such as colds or life-threatening diseases such as cancer, 'God's pharmacy' has a seemingly inexhaustible arsenal of active substances in store for innumerable ailments as well as for many environmental problems. Most of them have probably not even been discovered: of the roughly 370,000 currently known plant types, only ten percent have so far been tested for substances that could be used for medicinal purposes. The existence of many medicinal plants is nevertheless threatened – for example due to the clearance of the rain forests – and so there is a danger of valuable active substances being lost before humanity has even had a chance to benefit from them. Yet it is also frequently the case that the non-endangered species cannot be used for pharmaceutical purposes, either because they cannot be cultivated on a larger scale or because they produce only small quantities of the required active substances. One way out of this dilemma is provided by a biotech method developed over the past years and decades: it allows scientists to create cell cultures on special culture media from a pin-sized piece of tissue from a single plant, to reproduce them in unlimited numbers and to grow thousands of tons of cell mass from them. The further development of this method and its application for special purposes were the goals of the research subsidized by the 1989 Körber Prize.

Professor Dr. David Phillipson and his staff at the University of London examined the contents of a Euphorbia plant. This red juice known commonly as 'dragon's blood' is formed in the bark of certain tree species of the croton genus to be found in South and Central America. It can, for example, be used to treat wounds, infections, cancer, rheumatism and inflammations. The London-based pharmacologists isolated numerous active substances from the juice – including two previously unknown ones which they named Korberin A and Korberin B after Dr. Körber, the founder of the subsidy prize – and determined their anti-inflammatory and anti-bacterial efficacy. Experiments at the laboratories of Professor Dr. Meinhart Zenk in Munich and Professor Dr. Yury Y. Gleba in Kiev with the purpose of growing cell cultures from croton and extracting dragon's blood by biotechnological means were recently crowned with success. Professor Dr. Lutz Nover from Frankfurt, Professor Dr. Christian Brunold from Bern and the Zenk working group want to utilize an entirely different property of plants. They used cell cultures to study the mechanisms which allow some plant species to flourish on soil contaminated with heavy metals.

With the help of knowledge acquired so far the botanists hope to be able to reduce the heavy metal contamination in vegetable food produce, for example, and to decontaminate soils contaminated with heavy metals. This research group practically received assistance from the work of Professor Dr. Elmar Weiler and his team in Bochum. The plant physiologists developed highly sensitive methods for detecting active substances such as the belladonna active substance scopolamine, phytochelatines or toxic substances from fungi (mycotoxins). The detection method using antibodies makes it possible to trace active substances in such inconceivably small quantities as a trillionth (1/1012) of a gram. Finally, the working group headed by Professor Gleba succeeded in fusing wall-less plant cells – protoplasts – from different tobacco types as well as from tobacco and belladonna, and then in growing hybrid plants from them. With fusion the genetic material from different species can be combined. It is in these and other genetic manipulations that the greatest future opportunities probably lie for cell culture technology: thanks to them the yields of the required substances should increase considerably, or possibly even completely new active substances could be extracted from one plant cell.

Contact
Körber Foundation
Körber Prize
Kehrwieder 12
D-20457 Hamburg
Phone +49 40 · 80 81 92 -181
E-Mail koerberprize@koerber-stiftung.de