EUROPEAN COMMISSION / European Research Area

SmartCell

SMARTCELL

Rational design of plant systems
for sustainable generation of value-added industrial products

The main goal of Smartcell is to develop fundamental knowledge and enabling technologies so that plants and plant cells can be engineered to produce valuable secondary metabolites which can be successfully extracted and purified for industrial and medical uses. The use post-genomic technologies and cutting edge systems biology approaches in the project will enhance the output of specific target molecules, aiming at production levels sufficient for industrial purposes. Smartcell will contribute to take plant natural product biology well beyond state-of-the-art of conventional plant breeding efforts.
The four-year EU funded project brings together leading European laboratories in the field of metabolic engineering and plant secondary metabolism.

Background

Plants sustainably produce low molecular weight molecules – or secondary metabolites - of high industrial value. Metabolites are the product of the plant metabolism and some may be markedly toxic to other organisms, like antibiotics.
The individual molecules are often too complex for chemical synthesis, and plants naturally produce them only in tiny amounts mixed with many similar molecules, complicating technically and economically the product extraction and purification.
However, poor understanding of the metabolic pathways in plants has hampered the advancement of metabolic engineering and the exploitation of plants as Green Factories - Only 8% out of more than 400,000 plant species have been chemically characterized.
The EU funded SmartCell project aims at creating a novel concept for engineering plants towards improved economical production of high-value compounds for industrial and pharmaceutical use.
The project will develop an integrated database and a gene bank available for academic and industrial communities and provide new opportunities for SMEs and established European biotech companies.
The technology can also be transferred to other non-food related industries like fine chemical and pharmaceutical industries.

Objectives

- to understand and exploit the extraordinary diversity of the plant biochemical capacity to produce valuable molecules
- to functionally analyse the genes of interest and systematically explore factors that control the formation, regulation, transport, stability and storage of secondary metabolites
- to combine knowledge of the molecular regulation in vitro and in planta in order to develop a holistic and integrated view of secondary metabolite pathways and their products at systems level
- to develop and optimize methods for large-scale cultivation and downstream processing of secondary metabolites addressing bio-safety issues in transgenic plants and cell cultures

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SmartCell has also set aside project funds to encourage dissemination and outreach activities in order to promote the project and an interest in science generally. The outreach activities include an open access website, where members of the public can learn more about the project, which also promotes science in schools.

Results / Impact

Still under execution, SmartCell aims to achieve these results:

- an integrated framework for efficient engineering and production of plant secondary metabolites in plants and plant cells as Green Factories
- an interactive database of plant metabolic pathways and a repository of pathway related genes ready for expression in diverse systems
- a proven and industrially evaluated production system for valuable plant compounds

SmartCell provides new opportunities for SMEs and established European biotech companies, and the technology can also be transferred to other e.g. fine chemical and pharmaceutical industries.

For more information, please visit the website: www.smart-cell.org

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Project partners:
Technical Research Centre of Finland (Finland); VIB (Belgium); The Institute of Biology Leiden (The Netherlands); Universitat de Lleida (Spain); Fraunhofer IME, Aachen (Germany); University of Zürich (Switzerland); Université Catholique de Louvain (Belgium); Institute of Plant Molecular Biology (France); Zürich University of Applied Sciences (Switzerland); John Innes Centre (United Kingdom); Copenhagen University (Denmark); Max Planck Institut für Molekulare Pflanzenphysiologie (Germany); University of Oxford (United Kingdom); Wageningen University (The Netherlands); Plant Advanced Technologies-SAS (France); SoluCel Ltd (Finland); Philip Morris International