DISCO Tasks

Choice and evaluation of lignocellulosic matrices
The most suitable lignocellulosic materials, and the most appropriate pre-treatments needed to prepare them for enzyme degradation will be identified. The chemical, polymeric and anatomical structure will be characterised and assayed during enzyme degradation. Recalcitrant material will be analysed to discover the basis of its resistance.

Enzyme screening
Screening for novel enzymes will use relevant culture collections, enriched soil samples and enzyme collections to find those able to degrade selected materials. Genome mining and metagenomic libraries will also be screened. The characteristics of the most promising enzymes will be determined.

Protein production
Candidate enzymes from screening and genome mining will be produced and purified. Gene sequences encoding the most interesting cellulases and hemicellulases will be isolated, cloned and expressed in fungal expression hosts.

Mode of action and synergy of cellulose and xylan degrading enzymes
The precise mechanisms of action and preferred substrates of novel enzymes will be studied, and their synergy with xylanolytic enzymes assessed. The process of lignocellulose hydrolysis will be studied to identify bottlenecks in the system that limit the overall rate.

Evaluation of the novel enzymes in saccharification and fermentation
Enzymes will be evaluated for their ability to produce ethanol, from the selected starting material, using knowledge gained about their activity. In particular, efficiency of hydrolysis, synergy with other enzymes and enzyme recyclability will be assessed.

DISCO Partners

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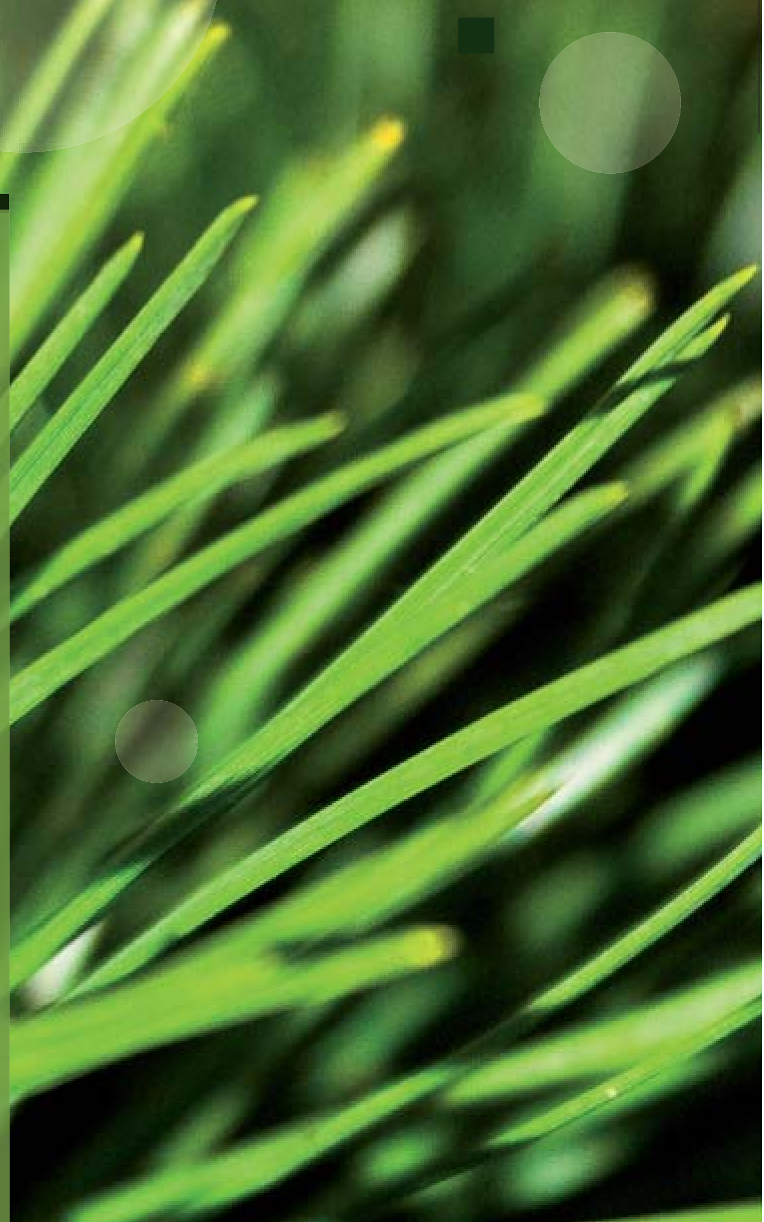
SEVENTH FRAMEWORK PROGRAMME



the targeted discovery of novel cellulases and hemicellulases and their reaction mechanisms for hydrolysis of lignocellulosic biomass

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DISCO Background

Renewable bioethanol from plant material is seen as an environmentally sustainable alternative to fossil fuels. Lignocellulosic biomass, including waste materials from forestry, agriculture (straw) and wood-based industries, is attractive as a raw material for conversion to bioethanol production. It is produced in abundance in Europe from renewable sources that do not compete with food crops for land or resources. In order to be converted to bioethanol, lignocellulose must be broken down into much simpler sugar molecules, which can be fermented into bioethanol. It is preferable that these two processes are carried out simultaneously. Lignocellulose is a complex of carbohydrate polymers (cellulose and hemicellulose) tightly bound to lignin. The dense structure of lignocellulose, whilst making plants and trees tough, also makes it resistant to enzymatic degradation, which has been a challenge for using lignocellulosic biomass for bioethanol production.

DISCO Aims

The aims of DISCO are to develop more efficient and cost-effective enzyme tools to produce bioethanol from lignocellulosic biomass, and understand how these enzymes work. By exploiting the natural diversity of microorganisms, our aim is to find new enzymes able to break down cellulose and hemiceullolose more efficiently. The synergy of different enzymes and the recyclability will contribute to increasing the efficiency of the process. Systems for industrial enzyme production will be developed, and the project will demonstrate proof of concept in a pilot study.

DISCO Benefits/Impact

DISCO is a collaboration between research institutes, universities and industrial partners, all of which are seen as leaders in their particular field. Drawn from across Europe and Russia, the partners will bring together their expertise to tackle the important challenge of developing sustainable renewable fuels. This is needed to help meet the European Union's directive to promote the use of biofuels and renewable fuels. Lignocellulosic biomass is produced in abundance within the EU, so its efficient conversion to biofuel would reduce the EU's dependence on imported oil.