

DISCO EXECUTIVE SUMMARY

1st Periodic Report

CONTEXT & OBJECTIVES

DISCO is an academic/industry alliance, consisting of pan-European partners and an ICPC¹ member from Chile with complementary multidisciplinary expertise. The project represents a timely opportunity to translate innovation into commercial practice.

The overall aim and concept of DISCO is a generic pipeline from discovery to industrial valorisation, using the very latest enabling technologies, to deliver sustainable biosources of plant derived products.

A key feature of the DISCO project is its potential to utilise and build on existing and previous EU investments, rapidly and efficiency transferring the tools and strategies developed to new plant derived target molecules. The bioactives and high-value compounds targeted in DISCO are carotenoids, other terpenoids and tropane alkaloids. These targets all desperately require the development of new sustainable biosources and “greener” production chemistries.

The RTD and demonstration activities of DISCO are industry driven and will:

- Exploit existing and evolving biodiversity in Solanaceae and Iridaceae to perform bioprospecting with state of the art metabolomic approaches for the targeted molecules of interest.
- Utilise proprietary high-throughput bioassays to assess the bioactivities of extracts and enriched compounds derived from the biodiversity collections accessed.
- Use the latest transcriptomics and network biology approaches to elucidate new biosynthetic and regulatory pathway components and their alleles involved in the formation of the DISCO targeted bioactives/high-value phytochemicals.
- Develop and incorporate enabling technologies into discovery, application and translational pipelines.
- Generate new biosources of high value carotenoids, terpenoids and tropane alkaloids by metabolic engineering and molecular breeding approaches.
- Develop down-stream processes and integrative biorefining strategies for co-product and biomass utilisation that reduce environmental impact.
- Demonstrate production feasibility and product effectiveness beyond the present state of the art.
- Perform cost benefit and economic analysis of the processes to generate business models and marketability strategies for the translation of DISCO prototypes into commercial practice.
- Complement previous EU funded programmes in the area and act as an intersectorial training vehicle for industry and academia to enhance the competence base of the European workforce.

The developments generated in DISCO will have real-life impacts reducing environmental impact, provide new material to benefit human activities and stimulate economic development.

¹ International Cooperation Partner Countries

SCIENTIFIC RESULTS

The DISCO project has **rapidly progressed its research and innovation activities** since the initiation of the project. This is in part due to well organised and efficient management, clearly benefiting from an experienced dedicated management partner and coordinator familiar with the partners individual needs and requirements. **Dissemination** has been a **key component** of the project especially in the initial stages to create the name awareness for DISCO. The corporate identify is now well established with presentations, flyers, posters, lanyards and leaflets.

Perhaps the **dissemination highlight** has been the **1st Annual Project Progress Meeting in Chile** hosted by project partner Fraunhofer Chile Research (FCR). This was the first time an EU project has been taken to this region of the world. In conjunction with the progress meeting an **international workshop on plant specialized metabolism** was performed, which was attended by more than 75 participants. This meeting hosted talks from members of the DISCO consortium and scientists from top Chilean universities and research organizations. Also included in this workshop were excellent presentations by **Early Stage Researchers** on their work. Finally, the meeting was rounded off with an **industrial forum** to highlight areas where industry needs activity to add value to their supply chains.

At all times DISCO has encompassed the activities of other ongoing projects in the area. For example, joint dissemination and updates between **BACHberry and TriForC** have been performed as well as forging links with **the BBSRC-NIBB for high value chemicals from plants**. Training programmes have been adopted within the DISCO consortium and greatly helped the development of the scientists involved.

Within the individual work packages notable progress has been made, building on previous EU investments. For example, the **EU-SOL Solananceae collection** has been **screened by metabolite profiling**. From which new alleles conferring fruit pigments have been identified and fast tracked into breeding programmes to deliver new sources of carotenes to the cosmetic industry. The ability of these extracts to confer health promoting properties is also underway and will add to the databases already created in the project. **Modern RNA/DNA sequencing technologies** has been embraced and a number of **large transcriptomic experiments** are underway to elucidate target pathways. The utilisation of this technology has been very productive in **elucidating the genes encoding biosynthetic enzymes in apo-carotenoid formation**. Recently, components of this pathway were published in PNAS. In the future we hope to see the Scopolamine pathway elucidated in a similar manner.

The enabling technologies being developed in DISCO's WP5 have seen major advances including an **optimised inducible expression system for plastid transformation**. The adoption and development of modular cloning resources using the **GoldenBraid system** and the **efficient creation of functional biosynthetic metabolons** were achieved. A key objective of the DISCO project is the **technical production and economic feasibility of the renewable sources** developed. In this case it is very pleasing to see that the consortium have been able to **develop greener approaches to down-stream processing**, shown scalability can be achieved and also demonstrated the effectiveness of the supply chain to deliver an aquaculture product that is economically competitive with chemical synthesis.

EXPECTED FINAL RESULTS AND IMPACTS

The outputs from the DISCO project will impact directly on a number of key strategic areas including:

- **The environment and sustainable development.** DISCO will create renewable biosources for high value chemicals (bioactives) that have traditionally been chemically synthesised. The utilisation of cheap renewable bio-resources and eco-efficient processes will reduce environmental impact in comparison to existing processes. Biomass utilization will also generate biofuels, reducing dependence on fossil fuels and contribute to a carbon neutral process. Within the first 18 months of the project the data generated has clearly started to show this is the case with a number of significant results capable of delivering translational impact in the field.
- **Industrial policy and employment.** The scientific and technological advances will potentially impact on European competitiveness creating new and increased markets leading to increased economic growth, prosperity and job creation. Industrial SMEs and multinational partners are actively involved in the programme fostering cooperation and capacity building at a global level. It is evident from the industrial partners wanting to join the consortium that industrial awareness and capacity is being created.
- **Agriculture.** The cultivation of new and underutilised crops as biosources for high value bioactives will stimulate Agricultural development in both developed and developing countries, the latter with the potential to address Millennium Development goals. The CGIAR centers have expressed an interest in transferring knowledge (i) in terms of the metabolite profiling platforms to assist in breeding programmes and how income streams can be generated from waste material and biorefining cascades.
- **Quality of life and health.** Through the development of platforms for the production of bioactives that are cheaper, have increased accessibility, new activities as well as conferring quality and health properties. In this way the quality of life and health of European populations will be improved.
- **European cohesion.** The project is truly pan-European, includes active industrial partners (30% of the total budget), an ICPC partner and a number of globally based associates. Through the transfer of technology and joint efforts of selected experts with complementary skills, industrial cooperation and capacity building on a global scale will be achieved.
- **Rural development.** The project will promote investment and development of rural economies at both a European and global scale the latter addressing Millennium developmental goals.
- **Scientific and technological quality.** The project offers scientific discovery with impact by furthering scientific advancement, public engagement to disseminate outputs and knowledge, education and training of the workforce and technology transfer to industries.