

# DISCO EXECUTIVE SUMMARY

## 2<sup>nd</sup> Periodic Report

### CONTEXT & OBJECTIVES

DISCO is an academic/industry alliance, consisting of pan-European and IPCP<sup>1</sup> partners 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 efficiently 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, providing new material to benefit human activities and stimulating economic development.

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<sup>1</sup> International Cooperation Partner Countries

## SCIENTIFIC RESULTS

The DISCO project has now demonstrated the advantages and benefits of the approach to the delivery of impactful science. The **pipeline from discovery to translation** has ensured that fundamental aspects can be incorporated into the process **adding value to the supply chain**.

The highlights of the project to date are:

- (i) The use of next generation sequencing technologies to elucidate **high value apocarotenoid production and tropane alkaloid formation**,
- (ii) aquaculture and poultry trials that show the **benefits of renewable admixes** over chemically synthesised products,
- (iii) an **inducible transplastomic system** capable of delivering high levels of high-value chemicals, without hindrance from perturbations to vegetative growth and
- (iv) the release of **phytoene as a commercial product** from tomato for use in cosmetics.

In the most recent period DISCO has also developed **multi-fractional biorefining cascades** to support, add value and improve sustainability of processes.

The significant project progress is in part due to well organised and efficient management, clearly benefiting from an experienced and 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 identity is now well established with presentations, flyers, posters, lanyards and leaflets.

The 3<sup>rd</sup> Annual Project Progress Meeting in Romania, hosted by project partner Proplanta, was an important event, taking the project to a new region and engaging with local scientists. Also included in this meeting were our regular presentations by Early Stage Researchers on their work and those that had received training through the network.

At all times **DISCO has encompassed the activities of other ongoing projects in the area**. For example, joint dissemination and updates between [BacHBerry](#), [ERA-IB PROCAR](#) and [TriForC](#) have been performed as well as forging links with the BBSRC-NIBB<sup>2</sup> for high value chemicals from plants. Training programmes have been ongoing within the DISCO consortium and a feature of the present reporting period has been the **cross-discipline training activities**.

Within the individual work packages notable progress has been made, building on previous EU investments. For example, other **Solanaceae collections have been screened by metabolite profiling**, from which new alleles conferring fruit pigments have been identified. These findings have helped leverage new funding opportunities. The ability of these extracts to confer health promoting properties has gone to stage II with initial “hits” being confirmed and enrichment carried out to focus our efforts. An example database has been created and will form the basis of a publication. The **inclusion of Modern RNA/DNA sequencing technologies** has enhanced our programmes resulting in the elucidation of more components of the target pathways. In many cases the activities have progressed to the manipulation of the pathways involved.

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<sup>2</sup> Networks in Industrial Biotechnology and Bioenergy (NIBB) of the Biotechnology and Biological Sciences Research Council (BBSRC)

The enabling technologies being developed in DISCO's WP5 have seen major advances including an **optimised inducible expression system for plastid transformation**, which has now been validated and has shown its potential. The adoption and development of modular cloning resources using the GoldenBraid system, Gibson cloning and MoClone has facilitated the rapid **inclusion of Synthetic Biology techniques** into the project. A key objective of the DISCO project is the **technical production and economic feasibility of the renewable sources** developed, which has been achieved. In line with the mid-term review we have added value to the central theme by **developing "greener" approaches to down-stream processing and identified other complementary valuable bioactives and chemicals**.

## 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 has created **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. The most recent project phase has generated data that clearly shows the utility of the approach with significant results capable of delivering translational impact in the field. The data generated has been compiled from two robust aquaculture and poultry trials. To add value, biomass utilization has been performed to generate biofuels, **reducing dependence on fossil fuels and contributing to a carbon neutral process**.
- 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. The DISCO project can report that a commercial **product derived from DISCO innovation was released** by a SME partner in conjunction with an academic partner. This has resulted in increased economic prosperity.
- Agriculture. The cultivation of new and underutilised crops as biosources for high value bioactives has stimulated agricultural development in both developed and developing countries, the latter with the potential to address the Sustainable Millennium Development goals. The incorporation of similar metabolite profiling techniques into the CGIAR<sup>3</sup> centers assessed of biodiversity and breeding programme has now been adopted.
- Quality of life and health. The feasibility studies performed in DISCO have now provided the data on the new 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.

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<sup>3</sup> Consultative Group on International Agricultural Research.

- 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. The training opportunities provided through DISCO have made a tangible impact on the professional and cultural development of staff and students, performing scientific and complementary activities.
- Rural development. The project will promote investment and development of rural economies at both a European and global scale, the latter addressing Sustainable 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. The delivery of a commercial product during this reporting period illustrates and supports the approach taken in DISCO to add value to a discovery pipeline.