Yeast Cell Factories: Training Researchers to Apply Modern Post-Genomic
Methods In Yeast Biotechnology

Sprawozdania

Informacje na temat projektu

YEASTCELL

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Final Report Summary - YEASTCELL (Yeast Cell Factories: Training Researchers to Apply Modern Post-Genomic

Methods In Yeast Biotechnology)

The YEASTCELL ITN trained 11 Early Stage Researchers (ESRs) in the field of Yeast Biotechnology. YEASTCELL ESRs worked within well-established, highly successful teams at 13 partner sites across Europe. The research being undertaken in YEASTCELL is at the fundamental/application interface and with a consortium comprising 9 Public Sector (6 Universities, 3 Research Institutes) and 4 Private Sector (2 large companies and 2 SME) partners, all ESRs received interdisciplinary training in both sectors. The programme will culminate with the award of 11 PhD doctorates and these individuals will go on to productive careers in the public or private yeast biotechnology sectors.

The research objectives of YEASTCELL were 2-fold:
• To expand the range and improve the performance of Saccharomyces cerevisiae in the biotechnology sector
• To develop knowledge, methodology and prototype strains to facilitate the exploitation of non-conventional yeasts for new applications in biotechnology.

Four of the projects in YEASTCELL focussed on improving the performance of wine and brewing yeast and analysing the pathways of flavour production. Two of the ESRs working in this area have examined the metabolic basis of yeast aroma properties and stress responses under wine-production conditions and have shed new light on lag-phase modulation and yeast stress resistance during the inoculation phase. The other projects in this area have delivered new understanding of the utilisation of the sugar maltotriose by S. pastorianus and its parental strains S. cerevisiae and S. eubayanus. This is of interest for brewing as maltotriose is slowly or poorly assimilated by many lager yeast strains. A key outcome in this area is that the ability of S. eubayanus x S. cerevisiae hybrids to consume maltotriose is inherited from its S. cerevisiae parent. In addition, new brewing strains with improved performance have been developed using non-GM methods.

Understanding metabolism and physiology in the industrial yeasts K. marxianus, and Z. bailii was also a key focus, with two ESRs looking to develop knowledge of properties such as sugar transport and acid-tolerance that are very useful for industrial production. One of the ESRs collaborated with ESRS working on both K. marxianus, and Z. bailii to carry out genome analysis and annotations of both K. marxianus, and Z. bailii using the Yeast Genome Annotation Pipeline (YGAP). That ESR also used genome sequencing to identify a key evolutionary event in the history of the strain Z. parabailii. Important work was also done on developing genome engineering technology for non-conventional yeasts.

The remaining projects were tasked with reprogramming yeast metabolic pathways for sustainable production of functional biomolecules, commodity chemicals and medicines. In one project fatty acid metabolism in yeast was reengineered to produce wax esters, molecules commonly used in cosmetics, personal care products, and other commercial applications. They are typically derived from petro-chemicals but developing an alternative source has become a priority. Another project has resulted in engineered yeast strains that produce aromatic molecules such as cinnamaldehyde. These aroma compounds have applications in agriculture and medical sciences but current production methods are

limited by scalability, production time and environmental impact. YEASTCELL research also took a step toward production of pharmaceutical cannabinoids for the treatment of pain. Reconstruction of the cannabinoid biosynthetic pathway in yeast provides a safe and reliable method of production that sidesteps the legal and social factors associated with illicit cultivation of the plant. IP has already been filed in relation to one of the projects and prototype strains for commercial exploitation are expected.

Aside from research outputs, the objective of YEASTCELL was to train 11 researchers to PhD level. Through team supervision and working in shared work packages ESRs were able to take full advantage of the facilities and expertise available throughout the consortium. Furthermore, each of the ESRs carried out at least one academic and one industry secondment to a partner lab. To achieve the training objectives of YEASTCELL the ESRs undertook local training at their University graduate schools and participated in the following network activities:

• 1st Summer School, July 2014
• Transferrable Skills Workshop, July 2014
• Network conference ISSY31, October 2014 (Public event attended by approx. 200 researchers)
• Journal Club webinar series, November 2014-April 2015
• Intellectual Property and Careers Workshop, August 2015
• 2nd Summer School, August 2015
• Transferrable Skills Workshop, August 2015
• 3rd Summer School, June 2016
• Transferrable Skills Workshop, June 2016
• Network conference PYFF6, July 2016 (Public event attended by approx. 250 researchers)
• Final Network Conference ISSY33, June 2017 (Public event attended by approx. 300 researchers)

YEASTCELL also contributed to knowledge sharing outside the consortium. The 2nd and 3rd annual Summer Schools were attended by external researchers as was an Intellectual Property Careers workshop, extending the training impact beyond the YEASTCELL ESRs. As its final event, the consortium organized the 33rd International Specialized Symposium on Yeast (ISSY33) in June 2017, under the auspices of the International Commission on Yeast. The themes of ISSY33 reflected the most recent and exciting developments from the world of yeast biotechnology. The meeting attracted 285 delegates and provided a showcase for YEASTCELL research. Five of the YEASTCELL ESRs were selected to give talks, 2 were selected for flash poster presentations and the remaining 3 presented posters.

The ESRs also participated in a number of outreach activities that were designed to engage the general public on the subject of yeast biotechnology - carrying out basic yeast experiments with school children, brewing beer for a University competition, a yeast biotechnology wiki and Facebook page. The last public engagement activity of YEASTCELL was an exhibition held in Cork City, Ireland. It used story boards to cover a range of topics from the historical applications of yeast in food and beverage production, to current developments in yeast biotechnology and the most modern applications of yeast cell factories and yeast engineering. Content was provided by YEASTCELL ESRs and they were on hand throughout the exhibition to discuss the importance of ongoing yeast research to meet societal and environmental challenges. YEASTCELL coordinator, John Morrissey, also gave a fascinating lecture on the history of yeast biotechnology and brewing in Europe. YEASTCELL partner Evolva presented their research on

Resveratrol and Lallemand offered tastings of two wines identical except for the yeast used to produce them. The story boards will be re-used and displayed in additional venues extending the timeline and original reach of the event.

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