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Integrated approaches for assessing cell factories for sustainable bioprocesses

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The pursuit of identifying efficient cell factory candidates for production of pharmaceutically relevant products and commodity chemicals, relies heavily on the successful selection of process suitable microorganisms. Hence the selection of efficient cell factories is paramount for successful scale-up to economically viable industrial processes. Accurate quantitative assessment of cellular performance is required for the evaluation of the overall suitability of a micro-organism as an industrial cell factory, ensuring that not only product but also process parameters are optimised.

Significant recent advances in genetic engineering coupled with the demand for novel cell factories, producing a wide range of bioproducts from renewable resources, has led to a dramatic increase in the number of fungal stains generated with potential applications in industrial biology. The revolution in genome sequencing has made rational design and metabolic engineering strategies available, and this has been coupled with a simultaneous advancement of increasingly efficient genetic engineering tools. These developments have been amplified by the advent of new high throughput molecular biology techniques such as USER cloning/fusion and EasyClone and recently, the genome editing system CRISPR/Cas9 has been demonstrated for filamentous fungi. In addition there is a growing demand for cell factories capable of utilizing non-conventional substrates such as glycerol and plant hydrolysates, where both molecular biology techniques and evolutionary engineering is employed in the design process. Consequentially, the bottleneck has shifted from strain construction to characterization, that with the increasing strain numbers makes it imperative to develop and employ high throughput systems for quantitative physiological characterisation.

This presentation will explore how we can integrate the approaches of quantitative physiology, metabolic engineering and systems biology to understand and exploit the full potential of fungal cell factories. Using examples from current research, we will discuss how a progression towards higher throughput, together with improved level of detail in physiological characterisation can pave the way for more rapid implementation of novel cell factories and new bioprocesses.