In synthetic biology, engineering principles are applied to biology to enable construction of predictable and modular production systems. A chassis is used as a platform on which standardized biocomponents are incorporated to create cell factories for applications. The optimal integration of component with host’s systems is crucial for the productivity of the cell factory. The understanding of individual parts is expanding but still a gap in know-how for putting parts together into more complex units and circuits of the host is widening. Thus, more understanding of the interactions of cell factories is required to enable the full exploitation of these novel systems. Simple and universal tools are required to enable the simultaneous study of the functionality of the cell factory in production conditions. In this project, a novel methodology \textit{(proChassis)} for quantification of functional proteome of the cell factory (containing chassis and integrated biocomponents) is introduced. The \textit{proChassis} toolset contains an easily genome-engineerable chassis, quantitative monitoring tools of cell factory, and computational approaches for system design and analysis. \textit{ProChassis} can be used in high-throughput manner and it can be universally exploited in cell-based production approaches. \textit{ProChassis} allows efficient design and optimization of the chassis for any kind of synthetic biology applications in future. As a proof-of-concept, the developed \textit{proChassis} toolset is used to implement a cell factory that efficiently converts renewable substrates to biofuels. This type of methodology has not been described before, and when realized, possibilities for an efficient development of cell factories for variable applications are improved. The consortium brings together several expertises: genome engineering (Prof. Karp group, TUT), computational metabolic analysis (Dr. Tommi Aho, TUT), and construction of molecular binders to be used as proteomic tools (Adjunct prof. Urpo Lamminmäki, UTU).

\textbf{FOCUSED PROTEOMIC ANALYSIS OF CELL FACTORIES (\textit{proChassis})}

\textit{Principal Investigators: Matti Karp, Tommi Aho, Urpo Lamminmäki}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{image.png}
\caption{During bacterial cultivations, the synthesis of a specific precursor molecule for bioenergy production can be visualized using monitoring system developed in prof. Karp’s group. The system allows rapid screening of different modifications and conditions for improved bioenergy production in real-time. (Picture: Ville Santala)}
\end{figure}

\textbf{MAIN PUBLICATIONS:}

Kannisto, M., Aho, T., Karp, M. & Santala, V. Metabolic engineering of \textit{Acinetobacter baylyi} ADP1 for improved growth on gluconate and glucose. \textit{Applied and Environmental Microbiology}, \textit{in press}.


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