

RESEARCH CONFERENCES

ESF-Bielefeld-CeBiTec Conference

Microbes and Industrial Biotechnology 2010

Park Inn, Bielefeld • Germany
21-24 November 2010

Chairs:

- **Volker Wendisch**, Chair of Genetics of Prokaryotes,
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Highlights & Scientific Report



Conference Highlights

Please provide a brief summary of the conference and its highlights in non-specialist terms (especially for highly technical subjects) for communication and publicity purposes. (ca. 400-500 words)

The 2010 ESF-Bielefeld University-CeBiTec conference on “**Microbes and Industrial Biotechnology**”, the first of a series of annual conferences on Advances in Industrial Biotechnology, promoted scientific excellence in microbial biotechnology by providing leading scientists and young researchers with a platform to present their work, to discuss current scientific understanding along with recent developments in key areas of industrial biotechnology, and to identify the priorities for further research.

About 100 participants from 25 nations both from academia and industry attended oral presentations organized in eight sessions. The sessions covered important aspects along the theme of the conference “Microbes and Industrial Biotechnology” such as Systems Biology, Metabolic Engineering of chemical compounds, Synthetic Biology, Biofuels, Secondary Metabolites, Protein production & Metagenomics. The program was completed by two poster sessions.

Subsequent to the oral and poster presentation program the **International Late Autumn School on “Advanced Techniques in Bacterial Genome Research”** with 24 early career researchers was held from 24-27 November 2010 at the Center for Biotechnology (CeBiTec), Bielefeld University, Germany. The following subjects were covered in two practical courses: ultrafast sequencing technologies, bioinformatics tools, high-throughput transcriptomics, state-of-the-art metabolomics/proteomics.

I hereby authorize ESF – and the conference partners to use the information contained in the above section on ‘Conference Highlights’ in their communication on the scheme.

Scientific Report

Executive Summary

(2 pages max.)

Biotechnological processes are of increasing significance for industrial production, a trend that will likely take up more momentum in the light of decreasing oil availability. Production processes in Industrial Biotechnology make use of recent advances in microbial research. Microbial strains for the production of e.g. fine chemicals, biofuels, secondary metabolites and proteins can now be developed by a rational design strategy. Such a strategy relies on the characterization and optimization of the microbial production host based on *omics* technologies, systems biology or synthetic biology approaches. Microbial Biotechnology will play an important role on our way towards sustainable use and production of renewable bio-resources.

A special issue on this conference will be published in the *Journal of Biotechnology*.

Scientific Content of the Conference

(1 page min.)

- Summary of the conference sessions focusing on the scientific highlights
- Assessment of the results and their potential impact on future research or applications

The conference had 8 sessions of oral presentations and two poster sessions. These covered important aspects of microbial and industrial biotechnology.

In the session on Systems Biology, Uwe Sauer from the ETH Zürich, Switzerland, described how metabolite fluxes are controlled by transcriptional regulation of their respective genes. Sef Heijnen from the Delft University of Technology, Netherlands, reported on the impact that thermodynamics has on Systems Biology. Frederic Sreenc from the University of Minnesota, USA, showed the relation between metabolic pathway analysis and evolution. Verena Siewers from the Chalmers University of Technology, Sweden, provided an overview of *Saccharomyces cerevisiae* as a platform for the production of fuels and chemicals.

In the session Metabolic Engineering for the production of chemical compounds, Alvaro Lara from the UAM, Mexico, reported on the use of non-PTS *E. coli* strains for the efficient manufacturing of plasmid DNA. Kay Marin from the University of Cologne, Germany, identified the first export system for succinic acid and reported on its role in succinate transport in *C. glutamicum*. Atsushi Yokota from the Hokkaido University, Japan, showed how glucose utilization is influenced by mutations in the respiratory chain. Philippe Soucaille from METabolic EXplorer S.A., France, talked about the metabolic engineering of *Escherichia coli* for the production of 1,2-propanediol and the corresponding integrated process development. Matti Karp from the Tampere University of Technology, Finland, described how various halophilic bacteria can be exploited for the production of 1,3-propanediol.

The session Synthetic Biology, was opened by a presentation of Akihiko Kondo from the Kobe University, Japan, who showed the how cell surface engineering may improve the production

of bio-fuels and chemicals from biomass. Trygve Brautaset from SINTEF, Norway, revealed new tools for controlled and high-level gene expression in Gram-negative bacteria. Julia Frunzke from the Forschungszentrum Jülich GmbH, Germany, reported on the Development of novel biosensors for the intracellular detection of metabolites and their use in monitoring producing strains. Miroslav Pátek, Institute of Microbiology, Prague, Czech Republic, reported on promoter engineering in the amino acid producing *Corynebacterium glutamicum*.

In the sessions Biofuels I and II, Jin-Ho Seo from the Seoul National University, Korea, reported on the combined protein and metabolic engineering of yeasts for the production of ethanol from cellulosic biomass. Eckhard Boles from the Goethe-University Frankfurt & Bultaco, Germany, showed how genetic engineering of industrial yeast strains enabled production of Bioethanol and Bobutanol from pentose and hexose sugars. Xinqing Zhao from the Dalian University of Technology, China, reported on the use of flocculating yeasts for ethanol production. Stefan Krahulec from the Graz University of Technology, Austria, talked on coenzyme recycling between Xylose Reductase and Xylitol Dehydrogenase for efficient pentose utilization by recombinant yeasts. Harald Ruijsenaars from BIRD Engineering, Netherlands, revealed a new pathway for degradation of *furfural and hydroxymethylfurfural in Cupriavidus basilensis*.

In the session Secondary Metabolites I and II, Jose Salas from the Universidad de Oviedo, Spain, showed how combinatorial biosynthesis can be exploited to increase structural biodiversity in natural products. Roel Bovenberg from DSM Biotechnology Center, Netherlands, reported on engineered fungal strains for production of pharmaceuticals. Rebecca Goss from the University of East Anglia, UK, revealed how chemical and biochemical syntheses can be used to understand, modify and produce secondary metabolites. Sergey Zotchev from the Norwegian University of Science and Technology, Norway, reported on the characterization and application of marine-derived actinobacteria in drug discovery processes.

In the session Protein Production & Metagenomics, Jozef Anné from the Katholieke Universiteit Leuven, Belgium, described how streptomycetes can be used for recombinant protein production. Mirjam Czjzek from the Centre National de la Recherche Scientifique, Roscoff, France reported on the carbohydrate degradation by heterotrophic marine bacteria and their use for glycoengineering. Andreas Schlüter from Bielefeld University & CeBiTec, Germany, reported on a metagenomics-driven analysis of a Biogas plant microbiome.

A special issue on this conference with the major contributions will be published in the *Journal of Biotechnology*.

Forward Look

(1 page min.)

- Assessment of the results
- Contribution to the future direction of the field – identification of issues in the 5-10 years & timeframe
- Identification of emerging topics

Since the development of ultrafast sequencing technologies genome research of industrial microorganisms becomes more and more important. *De novo*- and *re*-sequencing of pro- and eukaryotic microorganisms is carried out and bioinformatic tools for assembling and annotation of genome sequences are developed continuously. Moreover, reconstruction of metabolic networks based on annotated genome sequences will drive metabolic engineering. Genome-based Systems Biology makes use of all the "omics"-technologies, namely genomics, transcriptomics, proteomics and metabolomics and integration and interpretation of large data pools describing the results of these experiments is anticipated to yield models describing and eventually predicting cellular functions by simulation studies. These aspects will be considered to be followed up during the next conference focusing on microbial biotechnology.

The research topic biofuels has been touched by the current conference, but will be in the focus of the 2011 ESF-Bielefeld University- CeBiTec conference. Solar energy is one of the major options for a sustainable fuel source that will allow a switch to a carbon neutral energy economy. Many international research projects currently aim to use sun light as a major source not only for the production of electricity but also for the generation of new fuels. This includes the biological pathway via production of photosynthetically active biomass as well as biochemical, chemical and physical pathways with use of photosynthesis as a biological blueprint for the generation of new catalytic devices for the artificial production of sun-fuels such as hydrogen on industrial standards.

The research topic of Protein Production has only been in this conference for bacterial hosts, but it will be covered more deeply and from a different perspective in the 2012 ESF-Bielefeld University- CeBiTec conference. In recent years the significance of animal cells has increased considerably. Besides the utilisation of permanent cell lines for the production of complex recombinant proteins new approaches to tissue engineering and stem cell biology contribute to this increasing significance due to their social, medical and economic implications. For a sustaining development in cell culture technology, linking functional genomic analysis and bio-informatics with the so far domineering disciplines of cell biology, molecular biology and biochemical engineering is of decisive significance to foster the development from a predominantly experimental empiric and descriptive discipline to a model and theory based discipline.

▪ Is there a need for a foresight-type initiative?

The 2010 conference has focused on white or industrial biotechnology and we have not touched the important fields of green biotechnology and red biotechnology which will be covered in the planned 2011 and 2012 ESF-Bielefeld University-CeBiTec conferences.

Atmosphere and Infrastructure

▪ *The reaction of the participants to the location and the organization, including networking, and any other relevant comments*

During the whole conference the atmosphere was excellent. Discussions after the oral presentations were intense, but at the same time friendly. The poster sessions served as a forum for fruitful discussions and fostered the exchange between established and early career scientists as well as between industrial and academic partners. The hotel turned out to provide a very good infrastructure in a beautiful setting and its secluded location just out of the city center fostered continuous and lively exchange between the participants. We are awaiting the outcome of the questionnaire in order to receive feedback for the organization of the coming conferences planned to be held in Bielefeld. From the perspective of the organizing team we believe that the meeting has been very successful.