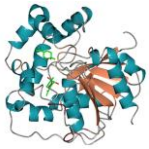

ESAB European Society of Applied Biocatalysis

SUSCHEM European Technology Platform for Sustainable Chemistry

ESAB-SUSCHEM Webinar

Broadening the Scope of Biocatalysis in Sustainable Chemistry

Thursday, 29th April 2021 at 14:00 – 16:00 CET
Welcome Address: Roland Wohlgemuth (Chairman ESAB); Vivi Filippousi (SusChem Manager)
Chairs: Pablo Domínguez de María (Sustainable Momentum, SL; ESAB Working Group Sustainable Chemistry and SusChem Management Team); Andrés R. Alcántara (UCM, ESAB Scientific Committee; SusChem Board)
Moderator: Jennifer Littlechild (Vice-Chairman ESAB), Willi Meier (DECHEMA, Secretary ESAB)

PROGRAMME

14.00 Roger A. Sheldon, Distinguished Professor of Biocatalysis Engineering at University of the Witwatersrand, School of Chemistry, Republic of South Africa. Emeritus Professor of Biocatalysis & Organic Chemistry at Delft University of Technology, The Netherlands.

Biocatalysis & Green Chemistry: Engineering a Sustainable Future
Two of the grand technological challenges of the twenty-first century are the 'greening' of chemicals manufacture and the ongoing transition to a sustainable bio-based economy with renewable biomass as the raw material. Biocatalysis has the right credentials to address these challenges. Enzymes are biocompatible, biodegradable and essentially non-hazardous. They are produced from inexpensive renewable resources and are not subject to large price fluctuations. Thanks to spectacular advances in molecular biology, the landscape of biocatalysis has dramatically changed in the last two decades. Developments in (meta)genomics in combination with computational-aided design have revolutionized new enzyme discovery and developments in protein engineering by directed evolution have enabled dramatic improvements in their performance. The ensuing broadening of the scope of biocatalysis, augmented by cost-effective immobilization methodologies and the implementation of continuous processing (biocatalysis in flow) have paved the way for the broad application of biocatalysis on an industrial scale.

14.30 Martin Schürmann, Principal Scientist at InnoSyn BV, The Netherlands, ESAB Scientific Committee

Selective Enzyme Catalysis for Efficient and Sustainable Chemical Processes
Enzymes are valuable tools in the synthesis of organic chemistry products because of their typically high selectivity and high efficiency under ambient reaction conditions. Especially their unmet chemo-, regio- and enantioselectivity enable synthesis route designs that can be much shorter than by conventional chemistry or chemo-catalysis, for example by unlocking cheaper or alternative raw materials or avoidance of protective group chemistry. In this contribution the efficiency and sustainability of selected industrial and pilot plant processes, that are enabled by aldolase, ammonia lyase and alcohol dehydrogenase biocatalysis, will be highlighted.

15.00 Michael Breuer, Senior Principal Scientist in White Biotechnology research, BASF

How Biocatalysis may contribute to more sustainable chemical production

Since 25 years BASF is committed to sustainability and sustainability is firmly anchored in BASF's strategy and corporate governance. Our purpose reflects what we do and why we do it: We create chemistry for a sustainable future. This means in the long term we create value added for the environment, society and the economy with products, solutions, and technologies.

In the context of sustainable chemical manufacturing biocatalysis plays an important role. This claim is illustrated by examples from current production and R&D.

15.30 Sabine Flitsch, Professor of Chemical Biology, MIB & School of Chemistry, The University of Manchester, UK

Applications of alcohol oxidases in enzyme cascades

Multi-step synthesis in biocatalysis has been made more efficient through the utilization of enzymatic cascades. No longer are reactions limited by intermediate isolation, thus significantly reducing time and waste. The design of multienzyme systems has provided convenient syntheses of a number of high value compounds and are now seen as the method of choice in implementing biocatalytic reactions. We have recently developed computer-aided synthesis planning (RetroBioCat platform [1]) to automate biocatalytic synthesis planning, allowing in silico prediction of novel biocatalytic cascades. A particularly useful class of biocatalysts in enzyme cascades are alcohol oxidases [2], which can generate reactive carbonyl intermediates such as aldehydes from easily accessible and stable alcohols for subsequent functionalisation. Here we discuss the design and development of alcohol oxidases with broad specificity that can be used at high substrate concentrations both in batch and in flow, as soluble and immobilised catalysts [3,4]. Oxidases have been used for small molecule oxidation as well as catalysts for selective modifications of glycoproteins [2,5].

[1] Finnigan, W.; Hepworth, L.J.; Flitsch, S.L.; Turner, N.J., Nature Catalysis 2021, 4(2), 98-104; [2] Rannes, J.B.; Ioannou, A.; Willies, S.C.; Grogan, G.; Behrens, C.; Flitsch, S.L.; Turner, N.J., JACS 2011, 133(22), 8436-8439; [3] Cosgrove, S.C.; Mattey, A.P.; Riese, M.; Chapman, M.R.; Birmingham, W.R.; Blacker, A.J.; Kapur, N.; Turner, N.J.; Flitsch, S.L., ACS Catalysis 2019, 9(12), 11658-11662; [4] Mattey, A.P.; Ford, G.J.; Citoler, J.; Baldwin, C.; Marshall, J.R.; Palmer, R.B.; Thompson, M.; Turner, N.J.; Cosgrove, S.C.; Flitsch, S.L., ACIE 2021, in press; [5] Mattey, A.P.; Birmingham, W.R.; Both, P.; Kress, N.; Huang, K.; van Munster, J.M.; Bulmer, G.S.; Parmeggiani, F.; Voglmeir, J.; Martinez, J.E.R.; Turner, N.J.; Flitsch, S.L., ACS Catalysis 2019, 9(9) 8208-8212.

ABOUT THE SPEAKERS

Roger A. Sheldon, a recognised authority on Green Chemistry, is widely known for developing the E factor for assessing environmental impacts of chemical processes. He is currently Distinguished Professor of Biocatalysis Engineering at the University of the Witwatersrand (SA). He received the RSC Green Chemistry Award and the Biocat Lifetime Achievement Award for important and lasting contributions to biocatalysis and was elected a Fellow of the Royal Society in 2015 and an honorary Fellow of the RSC in 2019. He has a Ph.D. from Leicester University (UK) and was at Shell Research Amsterdam (1969-1980), DSM-Andeno (1980-1990), Delft University of Technology (1991-2007) and CEO of CLEA Technologies (2006-2015).

Martin Schürmann is Principal Scientist responsible for Biocatalysis at InnoSyn B.V., which is the 2017 spin-out of DSM's former Organic Chemistry R&D group in Geleen, The Netherlands. After his Biology studies at Ruhr-University Bochum and PhD thesis at the Institute for Biotechnology at the Research Center Jülich he joined DSM in 2002. Here he focused on identifying and developing new biocatalytic reactions and their integration in organic chemistry processes, which is his current responsibility at InnoSyn as well. Next to being member of the ESAB Scientific Board, Martin is also co-chair of the joint working group Biotransformations of DECHEMA and the German Association for General and Applied Microbiology (VAAM).

Michael Breuer was born in 1965. After studying biology at the University of Bonn, he moved to the group of H.G. Floss at the University of Washington, Seattle. Following his PhD thesis on the biosynthesis of ansamacrolides in actinomyces (University of Bonn) he joined BASF central research in 1996. Currently he is working a senior principal scientist in White Biotechnology research. In this team he is engaged in the identification, characterization, and optimization of enzymes intended for the implementation in technical processes. These are biocatalytic syntheses of various chemicals ranging from optically active intermediates for agro and pharma products to aroma chemicals.

Sabine Flitsch is currently Professor of Chemical Biology at The University of Manchester, UK. Sabine has a long-standing interest in the application of biocatalysis to organic synthesis. More recently, she has developed multistep cascade reactions mediated by enzymes, both in cell free and whole cell systems for the stereoselective synthesis of carbohydrates and amines. Sabine obtained a Diploma in Chemistry from the University of Muenster, Germany and a DPhil degree from Oxford University under the supervision of Sir J E Baldwin. She spent three years of postdoctoral studies with Professor H G Khorana at MIT before returning to the UK to pursue her academic career at the Universities of Exeter, Oxford, Edinburgh and now Manchester, where she has held a Chair since 2004.

NEXT ESAB WEBINARS

Schedule and Topics of next ESAB webinars:

28 May 2021, 14.00-16.00 CET Biocatalysts from Extremophiles, organized by Jennifer Littlechild
June 2021, Synthetic Biology and Metabolic Engineering Tools and Methodologies
July 2021, Biocatalysis and Functional Genomics
August 2021, Joint US-European Webinar on Biocatalysis and Bioeconomy Education
3 September 2021, 14.00-16.00 CET, Standards for Reporting Biocatalysis Experiments, organized by Peter Halling

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You are cordially invited to join ESAB online *via* https://esabweb.org/Join+us/Application+form.html
Personal membership is free.

ESAB was founded in 1980 and has become the European Society of Applied Biocatalysis. ESAB aims to promote the development of Applied Biocatalysis and takes initiatives in areas of growing scientific and industrial interest in the field of Applied Biocatalysis.

ABOUT SUSCHEM

SusChem is the European Technology Platform for Sustainable Chemistry. It is a forum that brings together industry, academia, policy makers and the wider society. In partnership with European and national public authorities, SusChem contributes to initiatives that aim to provide sustainable solutions to society's big challenges. Together we develop and lead large-scale, integrated research and innovation programmes with chemical sciences at their core. SusChem has established a network of National Technology Platforms (NTPs) in 17 countries across Europe.

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