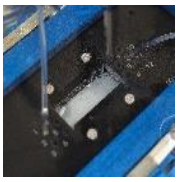

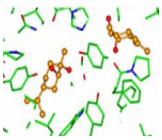
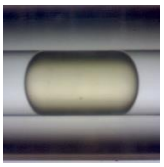

ESAB Webinar

Enzyme Engineering

February 25th 2022, 10.00-12.00 Central European Time (CET)
17.00-19.00 China Standard Time (CST)
18.00-20.00 Japan Standard Time (JST)

Chairs: Jennifer Littlechild (University of Exeter)
Roland Wohlgemuth (Lodz University of Technology)

PROGRAMME

10.00 CET Prof. Dr. Yan Feng, State Key Laboratory for Microbial Metabolism, School of Life Sciences, Department of Biochemistry and Biotechnology, Shanghai Jiao Tong University, Shanghai, P. R. China

Enzyme Evolution for Efficient Biosynthesis of Biofuel and Medicine

Progresses in synthetic biology have accelerated our ability to design and construct the novel pathways for biosynthesis. However, we still face great challenge caused by the shortages of suitable enzymes for the desired reactions. It is highly desired to reveal the complicated regulation mechanisms of enzyme and develop new strategies for designing the efficient molecular machine. Here, we introduced the new molecular evolution strategy based on the sector analysis of enzyme family. Furthermore, we described the biosynthesis for short-chain fatty acids and small molecular medicine in *E. coli*. The results showed that the precise control of enzyme functions could greatly enhance the adaptation of the artificial biological system.

References

[1] Zhiyun Wu, Hao Liu, Lishi Xu, Hai-Feng Chen, Yan Feng, Algorithm-based coevolution network identification reveals key functional residues of the α/β hydrolase subfamilies. *FASEB J.*, 34(2), 1983-1995 (2020), https://doi.org/10.1096/fj.201900948RR

[2] Xi Deng, Liuqing Chen, Mohan Hei, Tiangang Liu, Yan Feng, Guang-Yu Yang, Structure-guided reshaping of the acyl binding pocket of 'TesA thioesterase enhances octanoic acid production in *E. coli*. *Metab. Eng.*, 61, 24-32 (2020), https://doi.org/10.1016/j.ymben.2020.04.010

[3] Yuchang Luo, Qinqin Zhao, Qian Liu, Yan Feng, An Artificial Biosynthetic Pathway for 2-Amino-1,3-Propanediol Production Using Metabolically Engineered *Escherichia coli*. *ACS Synth. Biol.*, 8(3), 548-556 (2019), https://doi.org/10.1021/acssynbio.8b00466

10.30 CET Prof. Dr. Noriho Kamiya[1,2,3], [1]Division of Biotechnology, Center for Future Chemistry, Kyushu University, Japan, [2]Department of Applied Chemistry, Faculty of Engineering, Kyushu University, Japan, [3]KAICO Ltd., Japan

Biomolecular engineering with microbial transglutaminase

By combining the different functions of biomolecules, novel functional bioconjugates can be created. In addition, by introducing synthetic compounds into naturally occurring components, we can further enhance the usefulness of the native functions of biomolecules. The use of bond-forming enzymes that catalyze site-specific crosslinking reactions has been attracting attention to minimize the effects of chemical modification on the structure and functions of biomolecules. Here, we introduce the utility of microbial transglutaminase (MTG), catalyzing the crosslinking of specific Gln and Lys residues, to design various bioconjugates consisting of different functional entities such as nucleic acid-protein conjugates. Our current work on the design of lipid-enzyme conjugates and their application to antifungals will be also presented in line with the development of

11.00 CET **Prof. Dr. Miguel Alcalde, Department of Biocatalysis, Institute of Catalysis, CSIC, Marie Curie 2, 28049 Cantoblanco, Madrid, Spain**

Surfing the wave of oxyfunctionalization chemistry by engineering fungal unspecific peroxygenases

The selective insertion of oxygen into non-activated organic molecules has to date been considered of utmost importance to synthesize existing and next generation industrial chemicals or pharmaceuticals. In this respect, the minimal requirements and high activity of fungal unspecific peroxygenases (UPOs) situate them as the jewel in the crown of C-H oxyfunctionalization biocatalysts. Although their limited availability and development has hindered their incorporation into industry, the conjunction of directed evolution and computational design is approaching UPOs to practical applications. This lecture will address the most recent advances in UPO engineering, while discussing the future prospects in this fast-moving field of research.

11.30 CET **Prof. Dr. Marco W. Fraaije, Programme Director MSc Biomolecular Sciences, Molecular Enzymology Group, University of Groningen, Groningen, The Netherlands**

Redesign of oxidative enzymes for the biocatalytic valorisation of biomass

In this lecture, I will present some recent studies that we performed aimed at generating robust oxidases that act on biomass-derived compounds. Through selective oxidations, plant biomass-derived compound can be converted into high value building blocks. The examples will include the structure-inspired engineering of a glycerol oxidase, computational engineering of a robust HMF oxidase for production of FDCA, and the use of packaging proteins for stabilizing enzymes.

ABOUT THE SPEAKERS

Professor Dr. Yan Feng is Vice Director of State Key Laboratory of Microbial Metabolism and General Secretory of Shanghai Union of Synthetic Biology. She is currently Distinguished Professor of the School of Biosciences and Biotechnology, Shanghai Jiao Tong University, China. Her research focuses on the enzyme molecular evolution and Synthetic biology. Based on the structure analysis, she developed the strategies of protein engineering, including the Stepwise Loop insertion strategy (StLouis), Active site Stabilization (ACS), etc. for generating the novel enzyme function for efficient catalysis. Especially, she reprogrammed the metabolic pathway for synthesis of medicines and biofuels in bacteria and yeast.

Prof. Dr. Noriho Kamiya received his doctoral degree (engineering) in 1998 from Kyushu University, Japan, for his work on surfactant-enzyme complexes in organic media. Subsequently, he moved to The University of Tokyo as an assistant professor at Prof. Teruyuki Nagamune group and had opportunity to study at MIT as a visiting scientist at Prof. Alexander M. Klibanov group for one year. Then he joined as a faculty at Department of Applied Chemistry of Kyushu University in 2002, where he was promoted to a full professor at the Center for Future Chemistry in 2010. His research interests cover design and application of bioconjugates by bond-forming enzymes. He is now involved in a start-up company called KAICO aiming at insect biorefinery. Since June 2019, he has served as Editor-in-chief of Journal of Bioscience and Bioengineering (JBB) from the Society for Biotechnology, Japan.

ABOUT THE SPEAKERS

Prof. Dr. Miguel Alcalde studied Biology at the Universidad Complutense de Madrid, Spain (1988-1993) and in 1994, he obtained an M.Sc in Plant Physiology. In 1999, he completed his PhD in Biochemistry and Molecular Biology at the Institute of Catalysis (ICP-CSIC, Madrid). From 2001 to 2003, Dr. Alcalde took up a postdoctoral position at the Frances H. Arnold group, CALTECH. After his return to ICP-CSIC, he was appointed as Staff Scientist, promoted to CSIC Researcher (2014) and to full CSIC Professor (2019). Dr. Alcalde has been PI in more than 35 national and EU projects and contracts with industries. He is co-author of over 100 SCI papers and 14 patents. In 2019, Dr. Alcalde founded EvoEnzyme(https://evoenzyme.com), an emergent spin-off from his lab focused on enzyme engineering by directed evolution and applied biocatalysis. The central research of Dr. Miguel Alcalde primarily focusses on the engineering of enzymes by directed evolution for a wide range of biotechnological purposes as well as synthetic biology studies for environmental, energy and industrial applications (www.miguelalcaldelab.eu).

Professor Dr. Marco W. Fraaije is group leader of the Molecular Enzymology group at the University of Groningen, The Netherlands. His research focuses on the discovery and knowledge-based engineering of cofactor-dependent redox enzymes. Through detailed structural and mechanistic studies, new insights into the molecular functioning have been obtained, which has fuelled novel enzyme redesign strategies. In addition, his research has led to the development of several industrially relevant enzymes. Besides having a strong track record in the discovery and engineering of redox enzymes, Fraaije actively contributes to the biocatalysis community by organizing major scientific conferences and chairing (inter)national scientific committees. His scientific achievements have been the basis for awarding him the international BIOCATscience award. Fraaije's team is committed to both fundamental and application-oriented research, of which the latter occur in PPP projects in close collaboration with a variety of biotechnology companies. He is cofounder of the enzyme-based biotech company GECCO-biotech.

NEXT ESAB WEBINARS

ESAB aims to promote the development of Applied Biocatalysis and takes initiatives in areas of growing scientific & industrial interest in the field.
Schedule and Topics of the next ESAB webinars:

25th March 2022 14.00-16.00 CET	Biocatalysis for the Synthesis of Biomaterials organized by Roland Wohlgemuth, Francisc Peter and Jennifer Littlechild
22nd April 2022 14.00-16.00 CET	Advances in the Analysis of Enzymatic Reactions organized by Roland Wohlgemuth and Jennifer Littlechild

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