# A*STAR - Karlsruhe Institute of Technology Joint Mini Symposium

## TOWARDS A SUSTAINABLE WORLD

DATE

July 4th 2023

VENUE

Multi-Purpose Hall (MPH)
Level 1
Innovis
2 Fusionopolis Way

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# ABOUT THE A*STAR-KIT JOINT MINI SYMPOSIUM: Towards a Sustainable World

The A*STAR- Karlsruhe Institute of Technology (KIT) Joint Mini Symposium is a dynamic gathering of leading experts from A*STAR and KIT in a collective pursuit of a sustainable future. The topics covered include energy-efficient processes and devices, sustainable and new materials, and sustainable biomanufacturing. Gain invaluable insights, discover innovative strategies, and forge powerful partnerships that will drive positive changes towards a sustainable world.

This event aims to be a platform for meaningful scientific exchange and to pave the way to mutually beneficial collaborations.

**Committee Chairperson**

Dr. Lili Zhang, ISCE[2]

**Committee Advisor**

Dr. Peter Nagler, A*STAR

**Event Committee**

Dr. Yee-Fun Lim, ISCE[2]

Dr. Kevin Chong, Research Office

Ms. Nafisah Binte Mohamad Ismail, Research Office

Dr. Enru Lin, Research Office

Ms. Norjana Taib, Research Office

## A*STAR-KIT Joint Mini Symposium

4th July 2023

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|---|---|
| **08:30-09:00** | Arrival and Registration |
| **09:00-09:30** | Opening Speeches by Deputy Chief Executive (Research), A*STAR, **Prof. Andy Hor** and Vice-President (Innovation and International Affairs), KIT, **Prof. Thomas Hirth** |
| **09:30-09:40** | **MOU Signing Ceremony** |
| **09:40-10:10** | **Tea Break & Networking** |

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### Session 1: Energy-Efficient Processes and Devices

*Moderator: Dr. Lili Zhang, ISCE², A*STAR*

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| **10:10-11:30** | **Dr. Peter Holtappels, IMVT, KIT**<br>*Combining Micro Reactors and Electrolysis for Power2X Technologies*<br>**Dr. Yee-Fun Lim, ISCE², A*STAR**<br>*Electrocatalytic Production of Fuels and Chemicals*<br>**Prof. Jörg Sauer, IKFT, KIT**<br>*Catalysis for COx-Fixation to Intermediates and the Production of Fuels and Chemicals*<br>**Dr. Lili Zhang, ISCE², A*STAR**<br>*Research in Low-Carbon Technologies for Sustainability*<br>**Dr. Le Yang, IMRE, A*STAR**<br>*PROFESS – Printed Organic Flexible Electronics & Sensors*<br>**Dr. Kaicheng Liang, IMCB, A*STAR**<br>*Efficient Optical Technologies for Biomedicine* |
| **11:30-11:50** | **Block Q&A** |
| **11:50-12:00** | **A*STAR Graduate Academy (A*GA)**<br>*A*STAR's International Awards* |
| **12:00-13:20** | **Lunch & Networking** |

# A*STAR-KIT Joint Mini Symposium

4th July 2023

## Session 2: Sustainable and New Materials

*Moderator: Dr. Zhengtao Xu, IMRE, A*STAR*

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| **13:20-14:05** | **Dr. Zhengtao Xu, IMRE, A*STAR** |
| | *Molecular Weaving within Coordination Networks: Stable Radicals and (Super)conductivity* |
| | **Prof. Dr. Christof Wöll, IFG, KIT** |
| | *AI-Ready Multifunctional Molecular Solids via Atomically Precise Assembly of Building Blocks: The SURMOF Approach* |
| | **Dr. Zibiao Li, ISCE², A*STAR** |
| | *Next-Gen Circular Plastic Materials Towards Sustainable Applications* |
| **14:05-14:25** | **Block Q&A** |
| **14:25-14:55** | **Tea Break & Networking** |

## Session 3: Sustainable Biomanufacturing

*Moderator: Dr. Yee Hwee Lim, ISCE², A*STAR*

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|---|---|
| **14:55-15:45** | **Prof. Ute Schepers, IFG & IOC, KIT** |
| | *Sustainability in Personalized Health: Transporting Drug Candidates to Specific Organs in a Targeted Manner* |
| | **Dr. Yee Hwee Lim, ISCE², A*STAR** |
| | *Harnessing the Gems from Nature & Their Application in Fine Chemicals Biomanufacturing* |
| | **Dr. Ee Lui Ang, SIFBI, A*STAR** |
| | *Enzymes for Sustainable Biomanufacturing – Expanding the Molecular Repertoire and Getting There Faster* |
| | **Dr. Dave Ow, BTI, A*STAR** |
| | *Sustainable Microbial Biomanufacturing of Recombinant Growth Factors and Vaccines* |
| **15:45-16:05** | **Block Q&A** |
| **16:05-16:15** | Closing Remarks by Symposium Committee Advisor, **Dr. Peter Nagler** |

**BTI**: Bioprocessing Technology Institute
**IMCB**: Institute of Molecular and Cell Biology
**IMRE:** Institute of Materials Research and Engineering
**ISCE²**: Institute of Sustainability for Chemicals, Energy and Environment
**SIFBI**: Singapore Institute of Food and Biotechnology Innovation

# Session 1

## Energy-Efficient Processes and Devices


**Dr. Peter Holtappels**
Group Leader
Continuous Electrosynthesis
Institute for Micro Process
Engineering (IMVT)
KIT


**Peter Holtappels** is a group leader in continuous electrosynthesis at the Institute for Micro Process Engineering at KIT. He obtained his PhD at Forschungszentrum Juelich in 1996 before moving to Denmark for a postodoctoral position at Risø National Laboratory. Before joining KIT as a group leader, Peter was the head of programme at the Technical University of Denmark. His research interests include sustainable energy technologies, electrochemical energy conversion and storage technologies, CO2 capture and utilisation, and Power2X technologies such as electrofuels and electrosynthesis.

## Combining micro reactors and electrolysis for Power2X technologies

The synthesis of high energy dense fuels using renewable electricity (also called Power2X) typically involves multiple steps from hydrogen production, supply, and conversion of CO2 over a series of catalytic steps. Micro reactors, which have been developed also for the so-called Fischer-Tropsch process to produce synthetic fuels, enable modular plants and nicely match the scale of state-of-the-art electrolyzers. Examples of micro reactors f.i. for Fischer-Tropsch fuels will be presented and and combinations with high and low temperature electrolyzers in the Energy lab at KIT will be introduced.

**Dr. Yee-Fun Lim**
Deputy Director,
Catalysis and Green Process
Engineering (CGPE)
Institute of Sustainability for Chemicals,
Energy and Environment ($ISCE^2$)
A*STAR

**Yee-Fun Lim** is the Deputy Director of the Catalysis & Green Process Engineering division at A*STAR's Institute of Sustainability for Chemicals, Energy and Environment (ISCE2). Yee-Fun has a PhD in Applied Physics from Cornell University, which he pursued on an A*STAR National Science Scholarship. Upon graduation in 2011, he worked at the Institute of Materials Research and Engineering (IMRE) for 11 years, before joining ISCE2 in 2022. As the Co-I of the A*STAR funded Accelerated Catalyst Development Platform, his current research effort is focused on making use of AI machine learning optimization and high throughput experimental automation to accelerated catalyst discovery. He has a H-index of 33, with over 4000 citations.

## Electrocatalytic Production of Fuels and Chemicals

Industrial processes account for around 24% of all carbon emissions, and much of these are due to the use of fossil fuels as feedstock and energy source for heat production. Electrification of industrial processes using renewable energy thus represent a significant opportunity for carbon emissions reduction. Among various electrification processes, electrocatalysis possess unique advantages from an energy efficiency point of view. In this talk, I will discuss the various fuels and chemicals that are attractive to produce via electrochemical methods from a decarbonization and efficiency point of view, including hydrogen, ethanol, ethylene, and acetate. Following which, I will share our research efforts in these areas, and also introduce some new innovative tools that we have leveraged on in our research, such as high throughput experimentation and machine learning optimization in the Accelerated Catalyst Development Platform.


**Prof. Jörg Sauer**
Professor for Process Technology & Catalysis
Managing Director
Institute of Catalytic Research and Technology (IKFT)
KIT


**Jörg Sauer** studied Chemical Engineering at the Friedrich-Alexander-University of Erlangen-Nürnberg. After his graduation he went to the University of Karlsruhe (TH), now KIT, and earned his PhD on Chemical Engineering in the group of Gerhard Emig. He started his industrial career at Degussa AG in Hanau. He had different managerial positions at Degussa, later Evonik Industries AG, in Hanau (Germany), Mobile / Alabama (USA) and Marl (Germany) in the areas of research & development, production and process technology & engineering. As his last position at Evonik he served as head of the department Chemical Reaction Technology before he was appointed as full professor of Process Technology and Catalysis as well as head of the Institute of Catalysis Research and Technology in 2012.

His scientific research includes, among others: Chemical reaction engineering; scale-up of catalytic and thermochemical conversions; catalyst manufacturing; applied catalysis in the field of renewable derived fuels and last but not least technologies for circular carbon economy.

## Catalysis for COx-Fixation to Intermediates and the Production of Fuels and Chemicals

Processes for industrial COx fixation are important contributions to achieve ambitious climate goals and to close the anthropogenic carbon cycle in the "industry" and "mobility" sectors. Heterogeneous catalysis and anaerobic syngas fermentation are two different approaches to convert COx/H2 into chemicals, fuels and also compounds for food and feed. The selection of suitable processes for COx fixation requires the consideration of the entire process chain, from the provision of the carbon source and renewable energy to the application of the final products. In this presentation I will compare different reaction pathways for the fixation of COx and H2 into building blocks such as methanol, acetic acid and ethanol. The operating conditions, reactor technology, influence of gas impurities, yields, conversion efficiencies, and opportunities for further valorization of the building blocks and application of the final products will be compared.

**Dr. Lili Zhang**
Director, Catalysis and Green Process Engineering
Institute of Sustainability for Chemicals, Energy and Environment (ISCE$^2$)
A*STAR

**Lili Zhang** is Director of the Catalysis & Green Process Engineering at A*STAR's Institute of Sustainability for Chemicals, Energy and Environment (ISCE2). Lili is trained in Chemical and Biomolecular Engineering from National University of Singapore (NUS) and The University of Texas at Austin. She was a process engineer in Micron Semiconductor before her PhD. Dr. Zhang expertise in green catalysis, electrocatalysis, carbon utilization, waste upcycling, H2 production, carbon-based materials and their applications in energy storage and catalysis. She is Global Highly Cited Researcher. Dr. Zhang's research has led to more than 100 publications on high-impact international peer-reviewed journals with more than 25,000 citations (H-index: 54, by Web of Science).

## Research in Low-Carbon Technologies for Sustainability

Carbon negative and energy efficient technologies that could reduce greenhouse gas (GHG) emissions are among the greatest challenges of the 21st century. Therefore, developing processes and technologies with low GHG emissions to meet growing energy demand in a sustainable manner is of great significance. On the other hand, development of sustainable processes and technologies with atom economic and environmentally friendly methods for the production of chemicals and materials are highly desirable. In this talk, I will briefly talk about how use-inspired basic research helps to advance sustainability, with the focus on carbon utilization, clean energy production, 'greening' the processes, searching for alternative feedstocks, etc. Key research topics and activities in our Catalysis & Green Process Engineering Division will be discussed.

**Dr. Le Yang**

Group Leader, PROFESS Group
(Printed Organic Flexible Electronics & Sensors)
Deputy Department Head, Strategic Research Initiatives Department
Institute of Materials Research and Engineering (IMRE)
A*STAR

**Le Yang** received a Bachelor of Science (1st Class Hon) in Chemistry from Imperial College London, and PhD (Physics - Optoelectronics) from the University of Cambridge, under the A*STAR National Science Scholarships. In Cambridge, under the tutelage of Prof Sir Richard Friend, she and her colleagues discovered a new emission mechanism in a class of new materials, leading to a breakthrough and record-efficiency organic LEDs, useful for next-generation printable display technology. The work was published in Science, validated in international patents, and highlighted in a few journals and media outlets. Le is now working in IMRE, A*STAR, on luminescent materials, optoelectronics, flexible electronics and biosensors, leading her "PROFESS" Group (Printed Organic Flexible Electronics & Sensors).

Linkedin: https://www.linkedin.com/in/le-yang-670b8943/

## PROFESS – Printed Organic Flexible Electronics & Sensors

Relating to PROFESS, our group works on mainly two application-driven areas – organic optoelectronics and flexible electronics/sensors. On the former, we explore the properties of organic luminescent materials by harnessing their energy inter-conversion processes efficiently – such as between different colours of light (photon-upconversion), electrochemical energy to light (electrochemiluminescence), and between electrical and light energy (optoelectronics, OLEDs). These would construct sustainable structures/devices, targeting use-cases of agritech, flexible electronics, lighting, display and biosensing etc. On the other hand, we also foray into flexible electronics with the novel WISH (Wearable In-situ Sensorics for Health) design. This wearable electrochemical sensor enables unprecedented non-invasive real-time chemosensing on-skin or from sweat, encompassing new developments for a truly anyone-anywhere-anytime biochemical monitoring system for our health, being complementary and supplementary to existing commercial wearable trackers that usually focus on recording physical parameters.

**Kaicheng Liang** is a Principal Investigator at A*STAR Institute of Molecular and Cell Biology and Institute of Microelectronics, and Adjunct Assistant Professor at the Lee Kong Chian School of Medicine. His multidisciplinary team develops optical technologies for biomedical microscopy and imaging, with a focus on miniaturization and resource-efficient design. Kaicheng has a PhD from the Massachusetts Institute of Technology and a BS from Duke University, his studies generously funded by A*STAR.


## Dr. Kaicheng Liang

Senior Scientist III
Institute of Molecular and Cell Biology (IMCB)
A*STAR


### Efficient Optical Technologies for Biomedicine

Microscopes and endoscopes are used everywhere in biomedicine, from fundamental life science research to routine medical practice. As these technologies rapidly advance, they also balloon in complexity, carbon footprint and cost. Some of the most demanding imaging needs in biomedicine may be addressed by creative and remarkably compact solutions. My team has developed approaches that combine engineering and algorithms to enhance the process efficiency of optical imaging workflows, with minimal compromise on quality and insights.

# Session 2

## Sustainable and New Materials


## Dr. Zhengtao Xu

Principal Scientist I
Strategic Research Initiative
Institute of Materials Research and Engineering (IMRE)
A*STAR


After BS (1996) at Peking University, **Zhengtao Xu** had a plan for organic chemistry, but ended up with a PhD from Cornell on coordination networks (MOFs). After postdoc at IBM and faculty appointments at George Washington University—as life would have it— Xu started anew in Hong Kong (2005), became a professor in 2015, and relocated to Singapore in 2022. His team's work at IMRE/A*STAR carries forth the interest in catalytic and (super)conductive frameworks. Xu also enjoy Tolstoy, Schopenhauer and other classics. His team members closely integrate molecular design/synthesis and the study of porous framework materials (MOF, COF and open cage compounds), in order to open broad new horizons in materials science. His team is spearheading three forefront directions in open framework materials: 1) crystalline carbon frameworks (CCMs); 2) sulfur-functionalized metal-organic frameworks (SMOFs); 3) superconductive coordination polymers. In these three areas, the key properties of stability and reactivity are organically united in the open framework medium, such that the powerful sulfur functions and highly conjugated graphene motifs are driving deep innovations across catalysis, semiconductors, sensors, heavy metal removal, energy conversion/storage and superprotonic conductor and superconductor technologies.

## Molecular Weaving within Coordination Networks: Stable Radicals and (Super)conductivity


In the first part, we present organic radical systems that are stable even above 350 °C, surpassing the upper temperature limit (200 °C) observed for other organic radicals. The coordination networks build on alkyne- or sulfur-rich organic linkers which, upon heating, facilitates the formation of the radical centers while preserving the overall crystalline order. Such a post-synthetic thermal treatment also enables a strategy for accessing crystalline porous covalent networks of highly conjugated π-electron systems emulating the coveted 3D graphenes, achieving greatly enhanced stability, electroactivity and charge transport. In the second part, we report breakthrough in the modular synthesis of MOF solids extensively equipped with the mercaptan function, in order to fully exploit the unique metal-uptake, catalytic and electronic properties afforded by the thiol function, e.g., potential superconductivity observed of a designer coordination polymer system sporting the chemically soft mercaptan and hard carboxyl groups.
(www.tandfonline.com/doi/full/10.1080/21663831.2022.2057822)

**Prof. Christoff Wöll**
Professor in Physical Chemistry
Director
Institute of Functional Interfaces (IFG)
KIT

**Christoff Wöll** studied physics at the University of Göttingen and received his PhD in 1987 at the Max-Planck-Institut of Dynamics and Self-Organization with Prof. Peter Toennies. After a postdoctoral time (1988 to 1989) at the IBM research laboratories, San Jose, USA he accepted a position equivalent to Assistant Professor at the University of Heidelberg at the Institute of Applied Physical Chemistry. After his habilitation he took over the chair for Physical Chemistry at the University of Bochum (until 2009). In 2000 he founded the collaborative research center SFB588 "Metal-substrate Interactions in Heterogeneous Catalysis". Since 2009, he is the director of the Institite of Functional Interfaces at the Karlsruhe Institute of Technology.

## AI-Ready Multifunctional Molecular Solids via Atomically Precise Assembly of Building Blocks: The SURMOF Approach

Realizing molecular "Designer Solids" by programmed assembly of building units taken from libraries is a very appealing objective. Recently, metal-organic frameworks (MOFs) have attracted a huge interest in this context. Here, we will focus on MOF-based electrochemical, photoelectro-chemical, photovoltaic, and sensor devices. Internal interfaces in MOF heterostructures are also of interest with regard to photon-upconversion and the fabrication of diodes.

Since the fabrication of reliable and reproducible contacts to MOF-materials represent a major challenge, we have developed a layer-by-layer (lbl) deposition method to produce well-defined, highly oriented and monolithic MOF thin films on appropriately functionalized substrates. The resulting films are referred to as SURMOFs [1,2] and have very appealing properties in particular with regard to optical applications [3]. The fabrication of hetero-multilayers is rather straightforward with this lbl method.

In this talk, we will describe the principles of SURMOF fabrication as well as the results of systematic investigations of electrical and photophysical properties exhibited by empty MOFs and after loading their pores with functional guests. We will close with discussing further applications [4] realized by loading MOFs with nanoparticles or quantum dots and by creating molecular solids lacking inversion symmetry for second harmonic generation (SHG).[5]

We will also demonstrate that the SURMOF-approach is also well suited for the application of AI methods, e.g. Large Language Models (LLM) and Machine Learning (ML).

References:
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[5] A. Nefedov, R. Haldar, Zh. Xu, H. Kühner, D. Hofmann, D. Goll, B. Sapotta, S. Hecht, M. Krstić, C. Rockstuhl, W. Wenzel, S. Bräse, P. Tegeder, E. Zojer, Ch. Wöll, Adv. Mater. 33, 2103287 (2021)
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**Dr. Zibiao Li**
Director, Sustainable and Green Materials (SGM)
Institute of Sustainability for Chemicals, Energy and Environment ($ISCE^2$)
A*STAR

**Zibiao Li** is the Director of the Sustainable and Green Materials Division at Institute of Sustainability for Chemicals, Energy and Environment (ISCE2), Agency for Science, Technology and Research (A*STAR), Singapore. Li holds a joint appointment at the Institute of Materials Research and Engineering (IMRE) and is an adjunct Associate Professor at the National University of Singapore (NUS). His research interests focus on materials sustainability and MedTech polymers for healthcare applications.

## Next-Gen Circular Plastic Materials Towards Sustainable Applications

The strong covalent bonds or permanently crosslinked chemical structures in conventional plastics prevent them from being easily recycled, ending up in incineration plants. We aim to develop new materials technology that can keep plastic in use for as long as possible in a circular loop system, aiming to achieve zero waste and lower carbon footprint for a circular plastic economy in the long term. In this talk, Dr. Li will share his team's latest development of vitrimers, an emerging class of circular polymers that combine the best characteristics of thermoplastic and thermoset through dynamic covalent bond exchange and showcase their various material forms towards sustainable applications in water, energy, and green electronics.

# Session 3

Sustainable Biomanufacturing

**Prof. Ute Schepers**
Professor of Chemical Biology and Biochemistry
Institute of Functional Interfaces (IFG)
Institute of Organic Chemistry (IOC)
KIT

**Ute Schepers** studied Chemistry at the Kekule-Institut fur Organische Chemie und Biochemie, University of Bonn (Germany), where she completed her PhD thesis in the laboratory of Prof. Dr. K. Sandhoff in 1997. She then moved to Boston for a post-doctoral fellowship in the laboratory of Tomas Kirchhausen at the Department of Cell Biology, Harvard Medical School. She has been a Professor of Chemical Biology and Biochemistry at KIT since 2015. Her research areas include organ-targeted drug delivery, foldamers, HT-screenings, 3D bioprinting, biomaterials, tissue engineering, organ-on-chip technologies, and health technologies.

**Sustainability in Personalized Health: Transporting Drug Candidates to Specific Organs in a Targeted Manner**

In our interdisciplinary team, we are investigating how drug candidates can be transported to specific organs in a targeted manner. To address this issue in human tissue towards personalized medicine, we have developed organ-on-chip systems and are working intensively on 3D bioprinting of miniaturized organs and biomaterial development for tissue engineering.


## Dr. Yee Hwee Lim

Director, Group Leader
Chemical Biotechnology and Biocatalysis
Institute of Sustainability for Chemicals, Energy and Environment ($ISCE^2$)
A*STAR


**Yee Hwee Lim** currently heads the Chemical Biotechnology & Biocatalysis division at the Institute of Sustainability for Chemicals, Energy and Environment (ISCE2), A*STAR. Her research focus on harnessing the synergy between chemistry and biotechnology to develop innovative solutions for applications in therapeutics, chemicals manufacturing and waste processing. She obtained her joint PhD/DPhil from The Scripps Research Institute, USA and University of Oxford, UK where she was trained in natural product total synthesis (Prof. KC Nicolaou) and fluorination radiochemistry (Prof V Gouverneur) respectively.

## Harnessing the Gems from Nature & Their Application in Fine Chemicals Biomanufacturing

Brahalogenated natural products can display potent biological activities and specificities, and as such, this feature of halogen incorporation has been exploited commonly in medicinal chemistry to fine tune bioactivities and potency. Chemical halogenation typically requires harsh reagents and often leads to undesired polyhalogenated products. On the other hand, Nature incorporates halogens chemoselectively via a metal halide salts and halogenating enzymes under generally benign conditions.[2] One limitation of Nature's enzymes is their limited diversity (especially in the case of fluorinase) and substrate specificity. Here, we present recent studies on three classes of halogenases – fluorinase FlA1[3,4], phenolic halogenase RadH and pyrrolic halogenase PrnC[5] which have been applied to access a range of halogenated molecules, including an agrochemical fungicide analog, fludioxonil.

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**Dr. Ee Lui Ang**
Group Leader
Strain Engineering
Singapore Institute of Food and
Biotechnology Innovation (SIFBI)
A*STAR

**Ee Lui** received his Ph.D. in Chemical and Biomolecular Engineering from the University of Illinois at Urbana-Champaign & National University of Singapore Joint Program. He then joined Codexis Laboratories Singapore, where he held positions of Molecular and Cellular Biology Team Leader, and Project Manager for the BioIndustrial project. In 2012, he joined the Institute of Chemical and Engineering Sciences, A*STAR, leading the Metabolic Engineering Research Lab, and subsequently the Singapore Institute of Food and Biotechnology Innovation, A*STAR, as group leader of Strain Engineering.

His research interest is in developing synthetic biology tools to engineer biological systems for advanced biomanufacturing.

## Enzymes for Sustainable Biomanufacturing – Expanding the Molecular Repertoire and Getting There Faster

Alcohol oxidation is a key chemical transformation in synthetic routes for specialty chemicals including active pharmaceutical ingredients (APIs). Carbonyl (C=O) functional groups introduced through alcohol oxidation are convenient reactive handles amenable toward further modification. However, chemical alcohol oxidation typically involves elevated temperatures, stoichiometric oxidants, and toxic by-products. In contrast, biocatalytic alcohol oxidation possesses advantages such as high selectivity, mild reaction conditions, benign by-products, and sustainable operation in water instead of organic solvents.

In this work, we combined the power of prediction models with a systematic and comprehensive saturation mutagenesis survey of the key domains of the galactose oxidase enzyme to create an industrially relevant enzyme panel for secondary alcohol oxidation. We first significantly improve its activity against a challenging bulky secondary alcohol substrate. Subsequent engineering further expanded the galactose oxidase's substrate scope to include new substrates not accepted by the parent, improved its stability, and increased its solubility, thus improving the overall properties of the enzyme for biomanufacturing.


**Dr. Dave Ow**
Senior Staff Scientist
Microbial Cell Bioprocessing
Bioprocessing Technology
Institute (BTI)
A*STAR


**Dave Ow** is the group leader of the Microbial Cell Bioprocessing Group in Bioprocessing Technology Institute (BTI), Agency for Science, Technology and Research (A*STAR). Dave received his B.Sc. in Food science in 2001 in the University of New South Wales (UNSW) and his Ph.D. in microbial biotechnology in 2008 from the National University of Singapore (NUS). His thesis topic was on the system biotechnology and bioreactor fermentation of DNA vaccine producing bacteria. From 2007 to March 2010, he was a Research Fellow in the Microbial Cells group of BTI before he joined the Biomolecular Mass Spectrometry and Proteomics group (Utrecht University, Netherlands) for 1.5 years supported by an A*STAR post-doctorate fellowship. In BTI, he is actively involved in industrial and academic collaborations involving microbial expression and biomanufacturing. His research interests are in microbial cell factories for recombinant protein production and applied microbiology. Professionally, Dave is the honorary secretary of Singapore Society for Microbiology and Biotechnology (SSMB), a council member of Singapore National Academy of Science (SNAS). He is also an international executive board member of Asian Federation of Societies for Lactic Acid Bacteria (AFsLAB) and Asian Federation of Biotechnology (AFOB).

## Sustainable Microbial Biomanufacturing of Recombinant Growth Factors and Vaccines


Singapore is embarking towards a “30 by 30” food security goal, to produce 30% of the island’s nutrition by year 2030, via various sustainable routes including cultivated meat (CM) production and urban farming. Microbial biomanufacturing of CM media components such as growth factors and recombinant protein-based vaccines contributes towards this goal. Known for its rapid proliferation, low-cost and high-level expression capability, Escherichia coli is a common microbial cell factory for the expression of recombinant proteins, including mammalian growth factors. Another microbial host that has started to emerge as potential chassis for heterologous protein production are lactic acid bacteria, which are a family of “generally regarded as safe” organisms traditionally used in food fermentation. Compared to E. coli, they have a simpler genome and the advantage of an endotoxin-free secretory expression, which can facilitate downstream processing efforts. In this talk, I will introduce a few Singapore Food Story (SFS) funded projects that our group is currently working on.

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