Key Technologies in the Bioeconomy

KTB2023

The University Of Queensland
AUSTRALIA
CREATE CHANGE

27–29 September 2023

Key Technologies in the Bioeconomy: A Global Bioeconomy Alliance Conference

Full conference program

Welcome

In collaboration with the Global Bioeconomy Alliance including the Technical University of Munich (TUM) and São Paulo State University (UNESP), The University of Queensland (UQ) is proud to host The Key Technologies in the Bioeconomy: A Global Bioeconomy Alliance Conference.

The conference aims to stimulate conversation around global challenges and showcase solutions to inform the future of the bioeconomy – local and internationally. The conference will facilitate action-oriented and future-focused discussions on building a sustainable future amid a backdrop of unprecedented change and disruption.

Program

Wednesday 27 September

Time	Program
8:30-9am	**Opening session** Welcome address: **Professor Mark Blows**, Deputy Vice-Chancellor and Vice-President (Research and Innovation), The University of Queensland (UQ) Guest speaker: **The Honourable Cameron Dick MP**, Treasurer and Minister for Trade and Investment *Signing ceremony with UQ-TUM-UNESP*
Session 1: Decarbonisation	
Session overview: Many economies have set aggressive decarbonisation targets, but the scale and complexity of achieving these targets will require collective action across a range of pathways. This session explores what it will take to achieve net zero emissions, and the contribution of the bioeconomy in supporting decarbonised industrial development. View all session speakers. **Moderators:** Professor (Dr) Volker Sieber, Rector, TUM Campus Straubing, Technical University of Munich (TUM) Professor Ian O'Hara, Deputy Dean, Faculty of Engineering and Deputy Director of the QUT Centre for Agriculture and the Bioeconomy (CAB), Queensland University of Technology (QUT) Professor Roger Wepf, Director, Center for Microscopy and Microanalysis (CMM), UQ	
9-9:40am	**Plenary: Living in space, lessons for spaceship earth: a systems perspective** **Dr Jitendra Joshi**, Chief Technologist, New Energy, Woodside Energy Ltd
9:40-10am	**Net zero Australia: pathways to decarbonisation** **Associate Professor Simon Smart**, School of Chemical Engineering, UQ

10-10:20am	**Revolutionizing sustainable fish food: transforming CO2 from steel into proteins** **Dr Nele Ameloot**, Business Development Manager (BioMolecules), Ghent University
10:20-10:50am	***Morning tea break***
10:50-11:10am	**Queensland new industry development strategy** **Mr Mark Tierney**, Executive Director, Emerging Industries, Department of State Development, Infrastructure, Local Government and Planning
11:10-11:30am	**A view from the mid-transition: emerging challenges and implications for Australia's bioeconomy** **Mr James Boyle**, Associate Director, Deloitte
11:30am-12:15pm	**Moderated discussion and session wrap up**
12:15-1:45pm	***Networking lunch and poster session***

Session 2: Bioenergy and Green Hydrogen

Session overview:
This session will explore the fields of bioenergy and green hydrogen, with a unique focus on the Australian and Queensland context for Sustainable Aviation Fuel (SAF) production. As Australia rapidly accelerates its transition towards a low-carbon economy, the imperative to identify and harness sustainable energy sources has never been more paramount. View all session speakers.

Moderators:
Dr Esteban Marcellin Saldana, Group Leader (Marcellin Group), Australian Institute for Bioengineering and Nanotechnology (AIBN), UQ

Professor Bastian Blombach, Professor of Microbial Biotechnology, TUM

Chris Tindal, Strategic Biofutures Advisor, Department of State Development, Infrastructure, Local Government and Planning, and Assistant Director, Commercial Aviation Alternative Fuels Initiative

1:45-2:25pm	**Plenary: enabling sustainable aviation opportunities** **Chris Tindal**, Strategic Biofutures Advisor, Department of State Development, Infrastructure, Local Government and Planning, and Assistant Director, Commercial Aviation Alternative Fuels Initiative
2:25-2:45pm	**Bioprocess development for isobutanol production based on wheat straw** **Professor Michael Zavrel**, Professor for Bioprocess Engineering, TUM
2:45-3:05pm	**Engineering *pseudomonas taiwanensis* VLB120 for advanced biofuel production** **Dr Birgitta Ebert**, Senior Research Fellow, AIBN, UQ
3:05-3:35pm	***Afternoon tea break***
3:35-3:55pm	**Everything for zero: sustainable aerospace together**

	Heidi Hauf, Regional Sustainability Lead, Asia Pacific, Boeing
3:55-4:15pm	**Scaling SAF with alcohol to jet** **Flyn van Ewijk**, Director Project Development, Asia Pacific, LanzaJet
4:15-5pm	**Moderated discussion and session wrap-up**

Thursday 28 September

Time	Program
8:30-9am	**Opening session** Guest speaker: **Professor Michael Rosemann**, Director, Centre for Future Enterprise, QUT and Honorary Consul for Germany in Brisbane
Session 3: Sustainable Agriculture	
Session overview: Sustainable agriculture is of central importance to provide the resources necessary for the present population while conserving the planet's ability to sustain future generations. In this session we will discuss technological advances and policies that are necessary to safeguard climate-ready agriculture to balance agri-food and agri-energy demands while meeting the global emissions challenge. View all session speakers. **Moderators:** Professor Ian Godwin, Director, Centre for Crop Science, Queensland Alliance for Agriculture and Food Innovation (QAAFI), UQ Associate Professor Heather Smyth, Principal Research Fellow, Centre for Nutrition and Food Sciences, UQ	
9-9:40am	**Plenary: harnessing the power of metabolic engineering production of designer oils** **Dr Surinder Singh FAA FTSE**, Chief Research Scientists, Traits, CSIRO Agriculture and Food
9:40-10am	**Putting Mackay on the global bioeconomy map** **Kylie Porter**, Chief Executive Officer, Greater Whitsunday Alliance
10:10-10:20am	**How can emerging crops contribute to sustainable agriculture?** **Professor Rachel Burton**, School of Agriculture, Food and Wine, The University of Adelaide
10:20-10:50am	***Morning tea break***
10:50-11:10am	**Yield increase by genetic and epigenetic heterogeneity** **Professor Ueli Grossniklaus**, Group Leader and Director, Department of Plant and Microbial Biology, University of Zurich
11:20-11:40am	**Comprehensive molecular characterization of food: unveiling complex biochemical system** **Dr Stefan Pieczonka**, Postdoctoral Researcher, Analytical Food Chemistry, TUM
11:40am-12:15pm	**Moderated discussion and session wrap-up**
12:15-1:45pm	***Networking lunch and poster session***

Session 4: Local Foods and the Bioeconomy

Session overview:
Local foods represent a major opportunity for premium products in both domestic and export markets, capitalising on consumer interest in the provenance and traditional heritage characteristics of foods. Within Australia, local native foods offer a number of opportunities for sustainable economic, cultural, health and social benefits for Aboriginal and Torres Strait Islander peoples' enterprises and communities. View all session speakers.

Moderators:
Professor Yasmina Sultanbawa, Centre Director, Centre for Nutrition and Food Sciences, QAAFI, UQ

Dr Dharini Sivakumaran, Centre for Nutrition and Food Sciences, QAAFI, UQ

1:45-2:25pm	**Plenary: Aboriginal legacy for the Brisbane area and historical artifacts connected to food** **Madonna Thomson**, Managing Director, Jagera Daran and Chair, Indigenous Enterprise Group UQ QAAFI (ARC Industrial Transformation Training Centre for Uniquely Australian Foods)
2:25-2:45pm	**Genomic analysis of Australian plant species for food production** **Professor Robert Henry,** Professor of Innovation in Agriculture, Centre for Crop Science, QAAFI, UQ
2:45-3:05pm	**Australia's fungi, an untapped opportunity for a sustainable bioeconomy** **Sherie Bruce**, Postdoctoral Research Fellow, Centre for Nutrition and Food Sciences, UQ
3:05-3:35pm	***Afternoon tea break***
3:35-3:55pm	**Using archaeobotanical analysis of deep time archives as a source of knowledge to revitalise local food economies** **Professor Andrew Fairbairn**, School of Social Science, Faculty of Humanities, Arts and Social Sciences, UQ
3:55-4:15pm	**The challenges of accessing and researching Indigenous plants: an empirical investigation within and beyond the remits of Australian access and benefit sharing laws** **Dr Kamalesh Adhikari**, Research Fellow, School of Law, Faculty of Business, Economics and Law, UQ
4:15-5pm	**Moderated discussion and session wrap up**
6-8:30pm	**Conference dinner at Customs House** Guest speaker: **Mark Tierney**, Executive Director, Emerging Industries, Department of State Development, Infrastructure, Local Government and Planning

Friday 29 September

Time	Program
8:30-9am	**Opening session** Guest speaker: **Daniel Gschwind**, Chair, Trade and Investment Queensland and Honorary Consul of Switzerland in Brisbane
Session 5: Future Materials	
Session overview: The emergence of the bioeconomy is expected to have a transformative effect on future materials. The shift towards bio-based materials has the potential to reduce our dependence on fossil fuels, decrease carbon emissions, and contribute to a circular economy for the development of advanced biomaterials with unique properties, such as biodegradability, enhanced properties, and improved functionality. View all session speakers. **Moderators:** Professor Andrew Whitaker, Senior Group Leader (Whittaker Group), AIBN, UQ Professor Sagadevan Mundree, Head of School of Agriculture and Food Sustainability, UQ Dr Nasim Amiralian, Senior Research Fellow, AIBN, UQ	
9-9:40am	**Plenary: The circular bioeconomy in the development of smart biobased materials** **Professor Alcides Leao**, Department of Bioprocess and Bioengineering, School of Agricultural Sciences, UNESP
9:40-10am	**The biggest adventure of humanity** **Dr Florian Graichen**, General Manager, Forests to Biobased Products, Scion
10-10:20am	**The future of food: complementary proteins** **Professor Michelle Colgrave**, Deputy Director (Impact), CSIRO Agriculture
10:20-10:50am	***Morning tea break***
10:50-11:10am	**Biodegradable and bioderived polymers and composites – materials of the future** **Professor Bronwyn Laycock**, School of Chemical Engineering, UQ
11:10-11:30am	**Integrated closed loop organic waste management** **Dr Peter Harris**, Postdoctoral Research Fellow, University of Southern Queensland
11:30am-12:15pm	**Moderated discussion and session wrap up**
12:15-1:45pm	***Networking lunch and poster session*** *Announcement of poster session People's Choice Award*

Session 6: Critical Minerals – An Opportunity for the Bioeconomy in the Mining Sector

Session overview:
Critical minerals play crucial roles in information and renewable energy technologies, they underpin major strategies to establish low to no carbon-emitting processes in many industry sectors. Current extraction and separation procedures are, however, costly in terms of energy consumption and hazardous in regards of environmental impact. As a result, alternative, sustainable methods are required urgently.
View all session speakers.

Moderators:
Professor Rick Valenta, Director, Sustainable Minerals Institute (SMI), UQ

Dr Denys Villa Gomez, Advance Queensland Industry Research Fellow, AIBN, UQ

Professor Peter Erskine, Director, Centre for Mined Land Rehabilitation, SMI, UQ

1:45-2:25pm	**Plenary:** **Nicholas Gurieff**, Principal Advisor, Mine Closure R&D, Rio Tinto
2:25-2:45pm	**Biotechnical extraction and recovery of critical minerals from low grade ores and wastes** **Dr Anna Kaksonen**, Group Leader, Industrial Biotechnology, CSIRO
2:45-3:05pm	**Trash or treasure? Biomining of critical minerals from waste** **Dr Denise Bevilaqua**, Vice-Director, Institute of Chemistry, UNESP
3:05-3:35pm	***Afternoon tea break***
3:35-3:55pm	**Mining's future is biotechnology** **Professor Neville Plint**, Adjunct Professor, UQ
3:55-4:15pm	**Biotechnology and mining of critical elements** **Professor Gordon Southam**, Professor in Geomicrobiology, UQ
4:15-5pm	**Moderated discussion and session wrap**
5-5:30pm	**Closing session and next steps**

Speakers

Session 1: Decarbonisation

Professor Ian O'Hara, Session moderator
Deputy Dean of the Faculty of Engineering and Deputy Director of the QUT Centre for Agriculture and the Bioeconomy (CAB), QUT

Bio
Professor Ian O'Hara is Deputy Dean of the Faculty of Engineering at QUT. Professor O'Hara is widely recognised as an internationally leading expert in policies, technologies and systems for developing the bioeconomy and producing bio-based products including biofuels, bioenergy and biomaterials. Professor O'Hara leads the Australian project within the Australia–China Joint Research Centre for Biofuels and Biorefining. In addition to his academic role, Professor O'Hara represents the Queensland Government as the Biofutures Industry Envoy and acts as an ambassador for Queensland's biofutures industry and industrial biotechnology sector. As the Envoy, Professor O'Hara provides strategic advice to government and assists in securing domestic and international investment to grow the biofutures sector. He is a member of the International Advisory Council on Global Bioeconomy and is a senior editor of EFB Bioeconomy Journal.

Professor Volker Sieber, Session moderator
Rector, TUM Campus Straubing, TUM

Bio
Research conducted at Professor Sieber's Chair is aimed at developing technical processes for the sustainable production of bulk and fine chemicals from biogenic raw materials and renewable energy. The technological focus is on industrial (chemical) biotechnology. By applying methods from biochemistry, microbiology and molecular biology, new biocatalysts (enzymes, cells or micro-organisms) are developed and then combined with chemical catalysts in cascade reactions. Professor Sieber studied chemistry at the University of Bayreuth and the University of Delaware. After obtaining his doctorate he went to the California Institute of Technology as a research fellow. Following a brief sojourn at McKinsey & Co., Professor Sieber held a number of positions in the chemicals industry between 2001 and 2008 (Degussa, Süd-Chemie). He has been a full professor at TUM since late 2008. Since 2009, he has built up the Fraunhofer Institute's branch BioCat, which he currently directs.

Professor Roger Wepf, Session moderator
Director, Centre for Microscopy and Microanalysis, UQ

Bio
Professor Roger Wepf is the Director of the Centre for Microscopy and Microanalysis (CMM) at UQ. He was born in Strasbourg (France), and received academic degrees in cell biology and structure research in 1992 at the ETH Zurich. After a postdoctoral fellowship (Biocenter Basel/ETH Zurich), he joined the physical instrumentation program at EMBL, Heidelberg, in the Max Haider group, developing cryo-technology for corrected LVSEM and EM applications. Professor Roger was appointed junior group leader in the cell

biology program at EMBL in 1996. He then moved to Beiersdorf AG (BDF) for 9 years as head of the analytical microscopy department, in the research division of BDF based in Hamburg. He worked mainly on human skin morphomics of treated and untreated skin, colloidal systems, polymers and adhesives analytics meanwhile developing novel methods and instruments for nano-analytic technology research for in-vivo and ex-vivo studies. His main focus was developing cryo-preparation techniques for imaging and spectroscopy application including scanning probe techniques. Some of the instruments, which found their way to the market are a versatile high vacuum cryo-transfer system (VCT); cryo-stages for SEM and below the lens analytical instruments, a medical approved derma 2-photo laser scanning microscope together with JenLab, cryo-SPM adaptions, High Pressure Freezer (HPM100).
In May 2006 he was elected Director of the EM Center of the Swiss Federal Institute of Technology (EMEZ/ ETH Zurich) and became Technical Director of the Scientific Center for Optical and Electron Microscopy (ScopeM) in 2014. He served as President of the European Microscopy Society (EMS) from 2012–2016. Professor Roger's major research activities at ETH Zurich were focused on the field of correlative microscopy, automatic sample preparation and imaging techniques for particle imaging and spectroscopy technology. Currently his research direction leads to developing tools for integrative imaging and spectroscopy workflows and multimodal imaging and techniques with a focus on imaging mass spectrometry to explore new frontiers in structure research across UQ research disciplines.

Dr Jitendra Joshi
Chief Science Officer, New Energy, Woodside Energy Ltd

Title
Living in Space, Lessons for Spaceship Earth: A Systems Perspective

Abstract
Earth is a biological life raft that sustains human life in the inhospitable environment of the cosmos. This planetary closed-loop system provides oxygen, water and essential nutrients while recycling waste, purifying contaminants and renewing resources. We as spacefarers are learning just how this life raft functions to create a portable replica of the biological system we call home. Mimicking Earth's life support functions for long-duration space travel has its unique challenges as there are no buffers of huge land and water bodies. In trying to close the materials cycling loops for space missions there are several lessons learned that can be applied back on Earth. These lessons include systems engineering principles for developing integrated systems that are efficient and resilient.

Bio
Dr Jitendra Joshi serves as the Head of Carbon to Products and Alternate Fuels at Woodside Energy in Perth, Australia. Dr Joshi's responsibilities include formulation of strategy for converting Greenhouse gases to value-added products, and integrating renewables into Carbon transformation and Hydrogen generation. His team at Woodside Energy are implementing a combination of biological and thermo-chemical pathways to realise the full potential of greenhouse utilization and hydrogen production. Previously, Dr Joshi was the lead for Technology Integration within the Human Exploration and Operations Mission Directorate (HEOMD) at NASA. He has over 2 decades of science and technology project management experience with leadership roles in several research and technology development projects.

Associate Professor Simon Smart
Associate Professor, School of Chemical Engineering, UQ

Title
Net Zero Australia: Pathways to Decarbonisation

Abstract
The Net Zero Australia (NZAu) Project is a partnership between The University of Melbourne, UQ, Princeton University, and management consultancy Nous Group. NZAu uses the modelling method developed by Princeton University and Evolved Energy Research for its 2020 Net-Zero America study and is analysing net zero pathways that reflect the boundaries of the Australian debate. Irrespective of the pathway taken, our results nonetheless show that achieving net zero emissions for both Australia's domestic and export energy systems is an immense challenge and a once-in-a-generation, globally significant and nation-building opportunity. We can summarise what Australia must do in 3 points: deliver an energy transformation that is unprecedented in scale and pace, transform our exports as an essential contribution to global decarbonisation, and invest in our people and our land to reduce impacts and share benefits. These are easy to say, but each requires a transformation in our thinking and our actions in delivering greenhouse gas abatement while we continue to serve Australians and our export partners with the energy and other commodities that they need.

Bio
Simon Smart is Associate Professor in the School of Chemical Engineering at UQ. His research is centred around the sustainable production and use of energy and chemicals, including the development of enabling technologies and processes to produce clean energy, materials and water. Professor Simon has been involved in the Rapid Switch initiative, in relation to pathways to decarbonisation of the global economy, since its inception at the UQ Dow Centre for Sustainable Engineering Innovation. He is the UQ project leader for the Net Zero Australia project (a collaborative partnership with the University of Melbourne, Princeton & Nous). Simon has 126 publications, including 9 book chapters and 105 international journal articles at an h-index of 35, with 2 Highly Cited papers in chemistry and geoscience. He was selected as one of the 2018 Class of Influential Researchers by Industrial & Engineering Chemistry Research. He was awarded a prestigious Early Career Researcher Fellowship in 2012 from the Queensland Government to investigate silica based membranes for desalination applications in the coal seam gas industry, and a prestigious UQ Foundation Research Excellence Award for work on 'Low CO2 Iron and Petrochemicals Production' in 2016. Professor Simon was the Secretary for the Membrane Society of Australasia from 2011–2013, where he served on the board of directors from 2010–2014.

James Boyle
Associate Director, Deloitte

Title
A view from the mid-transition: emerging challenges and implications for Australia's bioeconomy

Abstract
The pace of global decarbonisation ambition continues to increase. But on the front lines, the technical, commercial, and policy challenges of deploying low-

carbon alternatives are becoming clearer and threatens to slow the transition before it has scaled. This talk will explore 4 major challenges of deploying decarbonisation technologies and trends in global green industrial policy, before reflecting on lessons for Australia's emerging bioeconomy.

Bio
Mr Boyle is a policy specialist in Deloitte's Climate and Sustainability practice with a decade of experience in public policy. He focuses on decarbonisation, new industry policy development, place-based economic transitions, and regenerative business models. He has led a range of impactful decarbonisation projects including for hydrogen project developers, hydrogen hubs, and governments considering development of green industries. Past projects have included setting up the UK's Green Finance Institute, negotiating a public-private green investment platform for India, strategy development for Australian manufacturing sectors, a green growth capital gap assessment in the UK, and development of the climate strategy for a pension fund. James has also authored a number of influential public reports, most recently Australia's Hydrogen Tipping Point, which examined the economic impacts of the US Inflation Reduction Act on Australia's clean energy aspirations. Prior to Deloitte, he was Head of Strategy at the City of London Corporation, leading international green finance and public-private initiatives for COP26. Mr Boyle has experience in economic policy in the UK and Queensland Governments.

Mark Tierney
Executive Director, Emerging Industries, Department of State Development, Infrastructure, Local Government and Planning

Title
Queensland New Industry Development Strategy

Abstract
Queensland is on the cusp of a new wave of economic growth, emerging from the opportunities presented by global shifts in demand for cleaner, greener, and more responsibly sourced products. Queensland's focus is on seizing the opportunities that global decarbonisation brings by being responsive and putting in place the right strategies, policies, programs and partnerships that will accelerate industry development and deliver sustainable economic growth. The Queensland New Industry Development Strategy was launched in May 2023, and sets out Queensland Government's approach to proactively grow key emerging industries that will be critical to the global shift to net zero economy. Mr Tierney, Executive Director of Emerging Industries within Department of State Development, Infrastructure, Local Government and Planning will provide an overview of the strategy and Queensland's key initiatives that aim to develop industries that will be in demand as the world decarbonises.

Bio
Mr Tierney leads the department's efforts to accelerate the development of the emerging Hydrogen, Biofutures and Resource Recovery industries; and also leads the flagship Industry Partnership Program. He has more than 20 years of experience in senior leadership roles in the Queensland public service. During his career he has been instrumental in leading and developing state-wide infrastructure strategies and delivery of industry development roadmaps for new and emerging industries. Mr Tierney and his team aims to make a positive difference for Queensland's economy and communities through industry

development – they have attracted Fortescue Energy's first hydrogen project to Gladstone; secured the Sanofi Translational Science Hub in South East Queensland; supported Vecco's battery manufacturing facility in Townsville; facilitated more than 40 recycling projects across the state; and, are working to establish the Sustainable Aviation Fuel sector.

Dr Nele Ameloot

Title
Revolutionizing Sustainable Fish Food: Transforming CO_2 from Steel into Proteins

Abstract
Researchers from Ghent University (UGent, BE) have pioneered a groundbreaking project that capitalises on steel manufacturer ArcelorMittal Belgium's CO_2 emissions to create proteins for fish food via fermentation. They successfully converted CO_2 into microbial protein, through an inspiring collaboration with ArcelorMittal Belgium and a feed additive company. Protein demand is escalating due to sustainability concerns, with conventional options like soy and fish meal facing environmental challenges. The UGent approach produces proteins from micro-organisms, offering a more eco-friendly alternative. The initiative addresses both climate responsibility and industry needs, propelling CO_2's second life as valuable protein. During the presentation you will explore not only this transformative process but also the ProteInn Club—an EU-based initiative accelerating the development of a unique fermentation-based protein ecosystem.

Bio
The BioMolecules consortium, led by Dr ir. Nele Ameloot, unites 25 UGent research groups, channelling cutting-edge research into bioeconomy and industrial biotechnology commercial potentials. With a background as a marketing and R&D director in the agri-tech industry, she pioneers novel business models. She manages IP, negotiates contracts, fosters spinouts of which Amphistar, Kojee, and B-cos are inspiring examples, and promotes UGent's biotech research for commercialisation. Beyond UGent, Dr ir. Nele Ameloot has her own consultancy firm, deepr, which provides technical and science-driven guidance to European stakeholders and industry associations. As a well-known speaker and lecturer, she educates on urban farming, food waste management, and biotech.

Session 2: Bioenergy and green hydrogen

Dr Esteban Marcellin Saldana, Session moderator
Group Leader, Marcellin Group, AIBN, UQ

Bio
Dr Esteban Marcellin's research is focused on advance biomanufacturing and systems and synthetic biology. Systems biology is a powerful tool to guide the improvement of fermentation processes. It is an important tool used to identify targets for metabolic engineering and to develop new microbial and mammalian production strains. Systems Biology is a knowledge driven approach that takes advantage of the growth in high throughput '-omics, (genomics, transcriptomics, proteomics and metabolomics) and uses mathematical models to accelerate learning. The models are functional annotations that can be probed to suggest potential metabolic engineering strategies (e.g. gene targets for knock out / up-regulation) to improve yield and productivity using synthetic biology. The models are refined and validated using biological '–omics data, leading to further iterative rounds of metabolic engineering to enhance production. AIBN's systems and synthetic biology goes beyond conventional 'omics studies to understand complex cellular behaviours in unconventional microorganisms. For example, using gas fermentation, we are consuming greenhouse gases (CO and CO2) as feedstock for fermentation and converting those greenhouse gases into valuable chemicals and fuels. The technology enables a decrease in our dependence on finite fossil fuel resources and improves sustainability for Australia and the chemical industry. Our projects aim at producing efficient cell lines to increase yields and productivities of mammalian cells lines for biologics production as well as microbial cell factories. In collaboration with leaders in the industry, such as Lanzatech, Amyris, Zoetis, Dow, CSL and Patheon Thermo Fisher we are applying systems metabolic engineering to enhance yields and to increase the production scope of the advanced biomanufacturing sector.

Professor Bastian Blombach, Session moderator
Professor, Microbial Biotechnology, TUM

Bio
Professor Bastian Blombach's research focuses on the development and optimisation of microbial production processes for chemicals and fuels from renewable raw materials. He uses methods of metabolic engineering, synthetic biology and systems biology to exploit the potential of established and novel microbial systems for industrial biotechnology and methods of genetic engineering in combination with metabolome analysis to construct tailor-made cell factories. The development of a quantitative and systemic understanding of the metabolism of the microbial platforms forms the essential basis of his work. Professor Blombach studied biotechnology at the University of Applied Sciences Weihenstephan and received his doctorate in 2009 from the Institute of Microbiology and Biotechnology at the University of Ulm. Beginning in 2012, he was junior research group leader at the Institute of Biochemical Engineering at the University of Stuttgart. He has headed the Professorship for Microbial Biotechnology at TUM Campus Straubing for Biotechnology and Sustainability since October 2018.

Chris Tindal
Strategic Biofutures Advisor, Department of State Development, Infrastructure, Local Government and Planning, QLD Government

Title
Enabling Sustainable Aviation Opportunities

Bio
Chris Tindal was appointed as the Strategic Biofutures Advisor to the State of Queensland. He provides a direct in-market connection between the Queensland Government and key industry stakeholders, both globally and domestically, but particularly within North America with a view to helping cement business relationships and projects for Queensland. The role was created to help identify and target strategic opportunities for North American-based biofutures organisations to establish operations in Queensland.

Mr Tindal is the Assistant Director for the Commercial Aviation Alternative Fuels Initiative (CAAFI) whose goal is to promote the development and commercialisation of alternative jet fuel options that offer equivalent levels of safety and compare favourably on cost with petroleum-based jet fuel, while also offering environmental improvement and security of energy supply for aviation. He helps to manage the coalition of CAAFI stakeholders and provide leadership and strategic guidance to CAAFI's State and Regional programs, Federal government interagency initiatives, airport authorities, and international initiatives consistent with CAAFI priorities.

He is an Adjunct Professor on the faculty of QUT's Centre for Agriculture and the Bioeconomy in Brisbane, Queensland. In that role, he assists in exploring research and development opportunities for QUT, as well as investigating potential opportunities to establish commercial-scale biorefineries in the State of Queensland.

He retired as the Director for Operational Energy underneath the Deputy Assistant Secretary of Navy for Energy, where he was in charge of setting energy policy and direction for the Department of the Navy and promoting the adoption of alternative fuels and renewable energy resources. Additionally, he developed intergovernmental, international, and industry relationships throughout the energy field. He was the Navy leader of the pioneering U.S. Department of Agriculture / U.S. Department of Energy / U.S. Navy Alternative Fuels Initiative, which developed programs to launch the advanced biofuels industry. In his role, he successfully led the Great Green Fleet effort, in which the U.S. Navy acquired and used 77 million gallons of F-76 alternative fuel blend for their ships in the Great Green Fleet deployment in 2016. The Royal Australian Navy was the first major ally to join the U.S. Navy in promoting interoperability with these alternative fuels in international Naval exercises in 2012. He has had the honour to be named in the peer-selected competition for the "Top 100 People in the Bioeconomy" Awards by the Biofuels Digest from 2013 through 2017. Chris Tindal was a Navy man for over 40 years. He graduated from the U.S. Naval Academy in 1980 with a degree in mechanical engineering, and served on Active Duty on 2 ships in Charleston, South Carolina. He retired as a Captain in the Navy Reserves in 2010. Originally from Alabama, Mr Tindal currently lives in South Carolina.

Professor Michael Zavrel
Professor for Bioprocess Engineering, TUM

Title
Bioprocess Development for Isobutanol Production based on Wheat Straw

Abstract
Despite the ongoing electrification of many transportation systems, renewable fuels will be needed for applications which are difficult or even impossible to electrify. Within the SynergyFuels project, funded by the German Federal Ministry of Transport and Digital Infrastructure, renewable fuels will be developed by combining Power-to-X processes with the utilisation of biogenic resources. To avoid any competition with the food chain, these biogenic resources should be waste streams or agricultural residues like wheat straw. Within this talk, the challenges of utilising agricultural residues will be addressed using the example of isobutanol, which is an important intermediate in the production of synergy fuels and also an interesting bulk chemical for the chemical industry. The production process is developed using a model-based design approach, including conceptual design, optimal experimental design, and tailor-made experiments. The process is planned to be scaled up to a demonstration plant size of 25 m^3.

Bio
Professor Michael Zavrel studied Chemical Engineering at TUM with a research stay at the University of California in Santa Barbara. After his diploma thesis at Roche, he did his PhD in biochemical engineering at the RWTH Aachen University. In 2008, he left academia and started his industrial career at Süd-Chemie and Clariant. Before he left Clariant, Mr Zavrel was Head of Development and Biomanufacturing and Site Manager for Clariant's biotech centre. After more than 13 years in industry, he was appointed as Professor for Bioprocess Engineering at the TUM Campus Straubing in 2022. His professorship deals with fermentation processes, downstream processing, and bioprocess design and focuses on the development of sustainable bioprocesses. Professor Zavrel is an inventor of 21 patent families and author of 14 peer-reviewed journal publications in the field of bioprocess engineering and member of the Editorial Board of the journal *Engineering in Life Sciences*.

Dr Birgitta Ebert
Senior Research Fellow, AIBN, UQ

Title
Engineering Pseudomonas taiwanensis VLB120 for advanced biofuel production

Abstract
The imperative to combat climate change demands a transition towards clean energy sources, with a critical focus on the energy sector, a major greenhouse gas contributor. The transportation sector remains heavily reliant on fossil fuels, necessitating innovative technologies to provide sustainable alternatives. Biofuels, such as ethanol and biodiesel (Fatty Acid Methyl Ester, FAME), have emerged as low-carbon alternatives, having reached large-scale production. However, their oxygenated nature and in case of FAME limited lipid-based feedstocks has prompted a shift towards developing drop-in biofuels based on hydrocarbons. Recent breakthroughs in synthetic biology light up the possibility of redesigning fermentation-based manufacturing processes using renewable

feedstocks. One promising approach is the biological conversion of sugars to fatty acid derivatives; however, engineering the metabolism of the microorganism responsible for fermentation is crucial to increase the attractiveness of this route. Our research aims to harness the metabolic versatility and stress tolerance of the microbe Pseudomonas taiwanensis VLB120 to produce fatty acid derivatives, specifically medium-chain length methyl ketones. These compounds, traditionally derived from petroleum-based hydrocarbons, serve as vital platform chemicals with applications in fragrance, flavour, pharmaceuticals, and agrochemical industries. Significantly, they hold promise as biodiesel blends and precursors for aviation fuels. Our achievement of approximately 10 g/L methyl ketone titers represents the highest reported recombinant production levels to date, underscoring the potential of Pseudomonas for biofuel synthesis. Nevertheless, current yields and production rates require optimization, and this presentation will outline a strategic roadmap towards establishing more competitive fermentation-based biofuel production.

Bio
Dr Birgitta Ebert studied chemical engineering from 2000 to 2005 at the TU Dortmund University (Dortmund, Germany) with a specialisation in biotechnology and technical chemistry. In her diploma thesis at the Chair of Chemical Biotechnology (TU Dortmund, Germany) she computationally analysed and experimentally verified the metabolic potential of Escherichia coli for whole-cell redox biocatalysis. During her PhD thesis, supervised by Professor (Dr) Andreas Schmid at the Chair of Chemical Biotechnology (TU Dortmund, Germany), she further applied systems biotechnological approaches to understand and engineer superior whole-cell redox biocatalysts. From September 2011 to April 2019, Dr Ebert led a research group at the Institute of Applied Microbiology at RWTH Aachen University (Germany) focused on the rational engineering of microbes to produce industrially relevant chemicals. In April 2019, she joined the Vickers Group at AIBN, UQ. Her research interest centres on gaining a systems-level understanding of microbial metabolism and the application of this knowledge to engineer microorganisms into cell factories for natural products.

Heidi Hauf
Regional Sustainability Lead, Asia Pacific, Boeing

Title
Everything for Zero: Sustainable Aerospace Together

Abstract
Aviation is a hard to abate industry that contributes ~2.5% of global emissions today. This relative share stands to grow as other modes of transport leverage alternative pathways for emissions reductions unavailable to aviation (e.g. electrification at scale). At the same time, aviation is responsible for more than 4% of global GDP, sustains 87 million jobs, and connects commerce and cultures. Our common goal is to have zero impact on our planet while maintaining and growing the societal benefits of air transportation. Boeing believes it is going to take everything to get us to net zero including fleet renewal, operational efficiency, and advanced technology. However, it is renewable energy that will be pivotal in reducing the lifecycle impacts of aviation energy carriers such as SAF, green hydrogen and electrification. We will need to rapidly scale and produce massive amounts of SAF if we are to meet the civil aviation's commitment to net zero by 2050. Boeing's intent is to

	help catalyse SAF scaling through subject matter experts and our investments in product compatibility work, our own fuel use, and with industry partnerships and policy advocacy, which Ms Hauf will be cover during this keynote presentation. **Bio** Heidi Hauf was appointed to the role of regional sustainability lead in January 2021, where she leads Boeing's advocacy on sustainable aviation policy and develops partnerships in support of aerospace sustainable goals. She supports the Boeing Australia Country President and leaders of Boeing Australia subsidiaries, to help leverage the innovation and enthusiasm of Boeing's employees. After starting her career as an intelligence officer in the Australian Army, she has worked on systemic sustainability issues across public services, natural resource management and business, advising leaders and developing corporate sustainability strategies as well as shaping government policy in regional Australia, Asia, East Africa, Europe and the UK. Ms Hauf currently lives in Brisbane, on Jagera and Turrbal Country. She has undergraduate qualifications in geography, environmental conservation, government and operations management, as well as post-graduate qualifications in international relations. She is a graduate of the Royal Military College - Duntroon. Ms Hauf currently chairs both the Sustainable Aviation Fuel Alliance of Australia and New Zealand and GreenSkies Aviation / Aerospace Australia.
	**Flyn van Ewik** Director Project Development, Asia Pacific, LanzaJet **Title** Scaling SAF with Alcohol to Jet **Bio** Flyn van Ewijk is Director, Project Development - Asia Pacific for LanzaJet where he is responsible for the planning, development and execution of the company's strategic objectives and sustainable aviation fuel projects across Asia Pacific. Mr van Ewik has close to 2 decades of experience in the aviation and sustainable aviation fuel sectors, and prior to joining LanzaJet Flyn was Director, Project Development for Fulcrum BioEnergy where he led the development of a municipal waste to sustainable aviation fuel project near Chicago, Illinois. Flyn has also managed and led sustainability programs at Qantas and Virgin Australia, including sustainable aviation fuel, energy strategy and environmental management functions.

Thursday Guest Speaker

Professor Michael Rosemann
Director, Centre for Future Enterprise, QUT, and Honorary Consul of the Federal Republic of Germany in Southern Queensland

Title
The German-Australian Bioeconomy Opportunity

Abstract
The growing maturity and scale of the German-Australian bioeconomy partnership demonstrates the benefits of a joint research initiative and capitalising on complementary assets. Beyond the immediate scientific advantages, this partnership is also a role model for how to address some of the most pressing challenges and how to jointly commit to shared research questions that can only be answered by global research teams of scale. Looking forward, this welcome message will be an encouragement to define a shared research agenda and desired futures fuelled by the new bioeconomy.

Bio
Dr Michael Rosemann is the Director of the Centre for Future Enterprise and a Professor for Innovation Systems at the Business School, QUT, Brisbane, Australia. Dr Rosemann's main areas of research are corporate innovation (eco)systems, revenue resilience, process management and trust management. His work is focused on creating compelling future worlds with today's possibilities that make current practices obsolete. As a researcher and advisor to board rooms and senior executives he is committed to advancing research-informed knowledge and confidence to appreciate the emerging design space and to create an increased 'sense of ambition'. Previously, he has been QUT's Executive Director, Corporate Engagement in 2017 and 2018. In this role, he was committed to the design of sustainable, mutually beneficial partnership models between significant industry partners and QUT. This included multi-disciplinary engagements and a focus on reducing research and curriculum latency i.e. the time it takes to react to emerging developments in QUT's research and teaching portfolio. Prior to this role, he was Head of QUT's Information Systems Discipline (2010–2011) and Head of the Information Systems School (2012–2016). QUT's Information Systems research received a ranking of 'well above world standard (5/5)' in this area of research in Australia (ERA, December 2015) and includes QUT's Business Process Management Discipline, one of the largest BPM research groups in the world. Under his leadership as a Head of School, he established 3 industry-funded Chairs in the Information Systems School i.e. the Woolworths Chair in Retail Innovation, the Brisbane Airport Corporation Chair in Airport Innovation and the PwC Chair in Digital Economy. In 2016, he was seconded to QUT's Real Difference project where he developed among others the rapid redesign methodology NESTT. The NESTT has so far been used for the re-design of 4 significant processes within QUT and has also been adopted by organisations such as the University of Auckland.

Session 3: Sustainable Agriculture

Professor Ian Godwin, Session moderator
Centre Director – Crop Science, QAAFI, UQ

Bio
Professor Ian Godwin has over 30 years' experience in plant biotechnology research, first undertaking sugar beet genetic engineering at Birmingham University in the UK in the 1980s. He joined UQ in 1990, holding an academic position in plant molecular genetics. In 2019, he joined QAAFI as Director of the Centre for Crop Science. He leads research in the use of biotechnological tools for crop improvement, with emphasis on the sustainable production of grain crops. Major focus is on the improvement of crops for food, feed and bio-industrial end-uses. He has pioneered the use of GM and gene edited techniques in sorghum. Research projects include international collaborations with a focus on food security and plant genetic resource conservation with collaborators in Germany, Denmark, the United States, China, Ethiopia and Pacific Island countries. He is passionate about the public communication of science, and has spoken at many public events on genetics, GM plants and food, animal cloning, and the future of agriculture in a changing climate. In 2003, he was an ABC Science Media Fellow, and has appeared on ABC and BBC radio on numerous occasions. His popular science book *Good Enough to Eat? Next Generation GM Crops* was published by the Royal Society of Chemistry in 2019.

Associate Professor Heather Smyth, Session moderator
Principal Research Fellow, Centre for Nutrition and Food Sciences, UQ

Bio
Associate Professor Heather Smyth is a flavour chemist and sensory scientist who has been working with premium food and beverage products for the past twenty years. With a background in wine flavour chemistry, her expertise is in understanding consumer enjoyment of foods and beverages in terms of both sensory properties and composition. Dr Smyth has a special interest in describing and articulating food quality, understanding regional flavours of locally grown produce, and modelling food flavour and textural properties using instrumental measurements. She also specialises in researching how human physiology, such as saliva and chewing behaviour, can impact sensory perception and therefore food choice. Current projects involve specialty coffee, beer, wine, native plant foods, cocoa, meat and seafood, tropical fruits, cereals, dairy products and some processed products and snack foods. She collaborates with a number of companies and research groups to discover how and why consumers enjoy food, which aids in the design and production of superior products with increased consumer value. Dr Smyth is also heavily involved in training industry and researchers in the application of flavour chemistry, sensory and consumer evaluation methods.

Dr Surinder Singh FAA FTSE
Chief Research Scientists, Traits, CSIRO Agriculture and Food

Title
Harnessing the power of Metabolic Engineering production of designer oils

Abstract
Achieving food security for a growing world population in the face of climate change is one of the defining challenges of the 21st century. Application of biotechnology to agricultural crops and microbes to address the food security has been gathering strength. For example, over the last 2 decades, advances in understanding of the biochemical and molecular mechanisms of plant oil biosynthesis, coupled with the cloning of many of the genes involved in this process, have facilitated the production of designer plant oils with improved nutritional benefits and enhanced functional properties. Dr Singh will describe the development of 2 such engineered oilseed crops that were developed at CSIRO Australia and are now in commercial production. Strategy to meet increasing demand for plant oils will also be discussed. He will also touch on the use of microbial fermentation to produce fats and oils that can be added to plant-based meat and dairy products to enhance flavour and texture.

Bio
Dr Surinder Singh is based at CSIRO Agriculture and Food and Nourish Ingredients in Canberra. He has pioneered the successful genetic modification of fatty acid composition in the seeds of canola so that they produce large amounts of the long-chain omega-3 oils that are essential for human health. He has also contributed to the development of highly stable safflower oil for industrial applications and the fatty acid metabolism in the leaves of certain crops to produce large amounts of valuable oils that are useful for food and industrial applications. Both omega-3 canola crop and safflower crops are in commercial production putting Australia at the forefront of bringing metabolically engineered oilseed crops to the market. Dr Singh is also involved in developing fats and oils for food via fermentation platforms at Australian start up Nourish Ingredients. He is an elected Fellow of Australian Academy of Sciences and Australian Academy of Technology and Engineering.

Kylie Porter
CEO, Greater Whitsunday Alliance

Title
Putting Mackay on the global bioeconomy map

Abstract
Mackay and the broader Greater Whitsunday region is on the verge of achieving a long-held desire to reinvent the local economy. Known for its metallurgical coal mining industry and technical know-how, the region has set its sights firmly on the bioeconomy and plans to leverage its significant agriculture feedstocks to become Australia's biofood epi-centre. So how does a region transition from legacy sectors such as agriculture, mining and manufacturing to biofoods? Chief Executive Officer of GW3, Kylie Porter will step you through the process and provide insights into a small region's ambitious plans for the future.

Bio
Kylie Porter is the CEO of Greater Whitsunday Alliance (GW3). GW3 is the peak independent, economic development organisation for the Greater Whitsunday region, the heartland of Australia's metallurgical coal mining industry. The organisation is a strategic point of contact for local, national and international networks and advocates for, and promotes prosperity across the Greater Whitsunday region. GW3's focus is not centred on one specific industry and has a remit to deliver across all key driving industries in the region including mining and METS, agriculture, tourism, the bioeconomy and others. Securing a long-term future for the region's 180,000 plus population is at the nexus of what GW3 does. Ms Porter has more than 25 years professional marketing and corporate communications experience, and is well versed on all the big issues of the Greater Whitsunday region today. Her family business, Porters Mitre 10, has been in continual operation in the region since 1883. She is also a founding Director of C-Res. C-Res delivers the Local Buying Program in partnership with BHP across all BHP assets across Australia.

Professor Rachel Burton
Professor, School of Agriculture, Food and Wine, The University of Adelaide

Title
How can emerging crops contribute to sustainable agriculture?

Abstract
In a world facing climate change, an expanding population and the need for increased food security, overlaid by the unique features of the Australian continent, we are seeking more sustainable agricultural solutions. Our current food and fibre systems are dominated by a narrow range of crop species, some of which owe their heritage to our European roots rather than an innate suitability to the wide range of growing conditions available across Australia. We are now seeking new plant species, better suited to the growing conditions we face today, to increase the suite of crops available and, if possible, not only to provide nutritious and sufficient food but to also help reduce the greenhouse gas emissions from the agricultural, energy and construction sectors. Some answers may be found in the use and development of emerging crops. Examples of these include industrial hemp and agave as multi-use plants perfectly suited to an integrated circular ecosystem where the concept of waste has been removed. Such crops have unique advantages, but are also a challenge since we have spent a lot less energy and time developing them in comparison to the staple crops we currently rely on. We have some interesting problems to solve. For example, Cannabis has been prohibited for decades, hampering research and the development of elite breeding lines, whereas some species of agave take 50 years to flower! Some of these challenges will be outlined but also the role of these emerging crops will be set in context as a promising resource in our efforts to establish sustainable agricultural systems that benefit the population and the planet.

Bio
Professor Rachel Burton is a plant scientist and molecular biologist, passionate about plant cell walls and developing novel crop options for modern agriculture including hemp, agave, sorghum, Plantago (psyllium) and chia. She is focussed on developing innovative pathways to make these crops multifunctional, useful for food, fibre, building materials, replacement plastics and medicine, but also highly sustainable and carbon neutral. This embraces

	the concept of using the entire plant, with no waste, as part of the integrated circular ecosystem, and as a means to reduce the greenhouse gas emissions from the agricultural, energy and construction sectors. Professor Burton has been a Chief Investigator in the ARC Centres of Excellence for Cell Walls and then for Plant Energy Biology and has been Head of the Plant Science and more recently the Food Science Departments in the School of Agriculture, Food and Wine at the Waite Campus in Adelaide. She was one of the 30 inaugural Science and Technology Australia's Superstars of STEM and subsequently served on the STA Board as the Plant and Ecological Sciences representative for 2 terms. She is one of the 2023 STA STEM Ambassadors, paired with a local MP in South Australia.
	**Professor Ueli Grossniklaus** Group Leader and Director, Department of Plant and Microbial Biology University of Zurich **Title** Yield Increase by Genetic and Epigenetic Heterogeneity **Abstract** Breeding more resilient crops with equal or increased yield under harsh conditions has become a major challenge in light of global climate change. Unfortunately, the genetic basis of many crop plants is very narrow as domestication and the development of modern cultivars imposed severe genetic bottlenecks. However, we could recently show that purely epigenetic variation is subject to selection and can contribute to novel phenotypes if it is sufficiently stable. Furthermore, there is ample evidence showing that diversity, either at the level of species or of genotypes within a species, leads to significant increases in productivity. Using the model plant Arabidopsis thaliana, we could show that epigenetic heterogeneity can also improve performance. Therefore, we propose that increasing epigenetic heterogeneity, through mixture and / or within given genotypes, should also be considered in future breeding programs. **Bio** Professor Grossniklaus studied molecular and cellular biology at the University of Basel, Switzerland, where he worked on maternal effects and segmentation in Drosophila melanogaster to obtain a PhD in 1993. In 1994, he set up an independent research group at Cold Spring Harbor Laboratory, USA, where he started to study plant reproductive biology, both sexual and asexual (apomixis). In 1999, he was appointed Professor of Plant Developmental Genetics at the University of Zurich, Switzerland, where his work centres on the developmental genetics of sexual and apomictic plant reproduction, using Arabidopsis thaliana and maize as model systems and transferring the knowledge gained to various crops. An important research area focuses on the epigenetic control seed development but also on the elucidation of the role of epigenetic variation in ecology and evolution. He has received various fellowships and awards, including a Searle Scholarship and a prestigious ERC Advanced Grant, and is an elected member of EMBO and Leopoldina.

Dr Stefan Pieczonka
Postdoctoral Researcher, Analytical Food Chemistry, TUM

Title
Comprehensive molecular characterization of food: Unveiling complex biochemical systems

Abstract
With the ever-increasing scale and technical ramifications of food supply networks, the uncertainties of climate, novel foods and sustainability efforts, the profound understanding of our food is assuming increasingly greater significance. Utilising targeted and non-targeted metabolomics proves beneficial in optimising their potential and assessing nutritional value and safety risks.
Foodomics combines classical chromatographic separation with mass spectrometry, alongside invasive and non-invasive spectroscopic analyses to explore the chemodiversity of food. Yet, direct infusion ultrahigh-resolution mass spectrometry (FT-ICR-MS) remains a rarely employed technique in analytical food chemistry. It possesses the capability to decompose the molecular complexity of food samples, resolve thousands of metabolite signals and provide a direct link to the food's compositional map. Leveraging cutting-edge technologies, we can investigate the previously unknown dark matter of our foods. By employing various complementary analytics, we unravelled molecular networks within the intricate chemical (Maillard reaction), biological (raw materials), and biochemical (fermentation) system that comprises beer.

Bio
Stefan Pieczonka studied food chemistry at TUM. He pursued his award-winning doctorate on the 'Comprehensive molecular characterization of the beer and brewing metabolome'. Affiliated with the Foodomics Platform at the TUM Chair of Analytical Food Chemistry, Dr Pieczonka specialises in the analysis of food and feed metabolomes, enabling him to elucidate complex processes and address intricate inquiries. His fascination with visualizing the molecular complexity and diversity inherent in nature drives him to explore the unknown and develop data-driven hypotheses. He employs complementary techniques, including ultra-high resolution mass spectrometry (FT-ICR-MS) to delve into the intricate molecular world of the chemical (Maillard reaction), biological (raw materials), and biochemical (fermentation) system that constitutes beer. His research insights encompass the diverse aspects of the Maillard chemical network in brewing, metabolite networks of Purity Law-related raw materials, and a forensic archeochemical analysis of Germany's oldest bottled beer.

Session 4: Local foods and the bioeconomy

Professor Yasmina Sultanbawa, Session moderator
Centre Director, Nutrition & Food Security, QAAFI, UQ

Bio
Professor Yasmina Sultanbawa's research is focused within the agribusiness development framework, specifically in food processing, preservation, food safety and nutrition. Her current research includes the minimisation of post harvest losses through value addition and the search for natural preservatives to replace current synthetic chemicals. In addition, her research area also includes the challenge of nutrition security, in particular micronutrient deficiency (hidden hunger), lack of diet diversity and nutritional losses in the food supply chain, which are addressed by her work with underutilised Australian plant species and potential new crops. Her work on Australian native plant foods is focused on incorporation of these plants in mainstream agriculture and diet diversification working with Indigenous communities to develop nutritious and sustainable value-added products from native plants for use in the food, feed, cosmetic and health care industries is a key strategy. The creation of employment, economic and social benefits to these remote communities is an anticipated outcome. She considers it a privilege to engage with these communities and is very passionate that her work will have a positive socio-economic impact.

Associate Professor Dharini Sivakumar, Session moderator
Centre for Nutrition & Food Security, QAAFI, UQ

Bio
Associate Professor Dharini Sivakumar's research primarily focuses on interdisciplinary programs aimed at creating small and medium agro-processing industries that produce innovative functional foods from Indigenous plant resources. This program also aims to improve the bio-economy by promoting grassroots innovation, creating employment opportunities, and preserving cultural heritage to empower rural communities.

Madonna Thomson
Director, Nyanda Cultural Tours

Title
Aboriginal legacy for the Brisbane area and historical artifacts connected to food

Abstract
The link between plant food and its connection to health, culture and caring for country has been an integral part of Indigenous culture for thousands of years. Through her showcase of artefacts from the Brisbane area, Madonna will demonstrate this legacy, and the links between past, present and future. She will talk about the value of ancient ingredients and knowledge in contemporary food systems and products while helping the audience understand the Indigenous perspective and cultural connection to these foods, and their critical

role in developing food products that are sustainable, delicious, healthy and environmentally and socially positive.

Bio
Madonna Thomson is the Director of Nyanda Cultural Tours, an Aboriginal owned enterprise which supplies authentic Aboriginal experiences to school, conference and corporate clientele; and owner of Jagera Daran Pty Ltd, a long established, 100% Aboriginal owned and operated Cultural Heritage Consultancy in South East Queensland. Ms Thomson is a proud First Nations woman – a member of the Jagera People and is a grand-niece of the late Senator Neville Bonner. Madonna has worked with First Nations communities in South East Queensland with a particular focus on developing and sharing traditional knowledge about management of the State's natural resources and environment. She has worked with UQ for the past few years, in the ARC Industrial Transformation Training Centre for Uniquely Australian Foods as a research partner, Indigenous Advisory group member and Indigenous Enterprise Group Chairperson for the centre. She is also the Chairperson of BushTukker and Botanicals Indigenous Enterprises Cooperative a 100% Indigenous owned and led cooperative, which is focused on growing the native botanicals industry.

Professor Robert Henry
Professor of Innovation in Agriculture, Centre for Crop Science, QAAFI, UQ

Title
Genomic Analysis of Australian Plants Species for Food Production

Abstract
The diverse Australian flora has many species that are crop wild relatives or have potential as new crops. Use of these species is critical in adapting food production to future climates and ensuring food security. Genome analysis has revealed many novel genes that will be useful in the improvement of current crops. Some species show potential for rapid domestication by gene editing to become completely new food sources. Diversification of crops contributes greatly to food security. Examples of local food resources include those for improvement of global crops such as rice, sorghum, millet and citrus. Macadamia is an example of a local species that has been recently domesticated. Many more species represent totally new options. Conservation of these resources in situ and ex situ is essential to the success of the diversification of food production.

Bio
Professor Robert Henry conducts research on the development of new and improved products from plants. He is Professor of Innovation in Agriculture and QAAFI Director at UQ (May 2010–September 2020). His research targets improved understanding of the molecular basis of the quality of products produced from plants and genome analysis to capture novel genetic resources for diversification of food and energy crops.

Sherie Bruce
Postdoctoral Research Fellow, Centre for Nutrition and Food Sciences, UQ

Title
Australia's fungi, an untapped opportunity for a sustainable bioeconomy.

Abstract
Local food solutions in the bioeconomy encompass a wide range of initiatives that promote sustainable and locally sourced food production, processing, and consumption. Australia's Aboriginal and Torres Strait Islander communities often have traditional knowledge and practices for sustainable food production and there is good understanding of Australian native plants consumed. However, there is little written knowledge of fungi used by Indigenous Australian peoples. My PhD research focuses on investigating and recording First Peoples' fungi knowledge and Australian native mushrooms as another potential native food crop for Australian Indigenous Australian peoples to grow and harvest. Investigating, and supporting Indigenous fungi knowledge can preserve cultural heritage, promote biodiversity, enhance local food security, and enable more opportunities for communities to earn income and remain on Country.

Bio
Ms Sherie Bruce is an Arrernte woman from Mparntwe (Alice Springs) with a deep cultural connection to the Yolngu, from the Northern Territory, where she grew up on Country. She is an environmental scientist who is passionate and committed to combining First Peoples' Traditional Knowledge / Science with Western science. She has over 25 years of experience in various areas, including project leadership, organisational change, communications, training development and delivery, and organisational development. This experience has been across all sizes of businesses and organisations in the public and private sectors. Her environmental science skills were developed over 10 years in the mining, state government and not-for-profit environmental conservation sectors. Her passion for combining Aboriginal and western Science enables her to facilitate opportunities to embed Aboriginal perspectives and outcomes that position Australia's First Peoples at high-level decision-making tables. She is undertaking her PhD at UQ, investigating Aboriginal Traditional Ecological Knowledge of fungi in Northern Australia, and developing commercial opportunities for First Peoples' on Country.

Professor Andrew Fairbairn,
School of Social Science, UQ

Title
Using archaeobotanical analysis of deep time archives as a source of knowledge to revitalise local food economies

Abstract
In exploring the potential of local foods to reinvigorate economies, health and cuisine, archaeology provides an invaluable source of information about the past to partner Indigenous knowledges, historical and ethnobotanical accounts and the exploratory approaches of plant scientists. Through investigation of the seeds, fruits and other plant parts preserved in archaeological sites – the discipline of archaeobotany – deep time archives of plant use can be accessed extending back tens of thousands of years. Such records allow us to understand which and how long specific plants have been used, as well as the

history of their entrainment in economies through foraging, cultivation and domestication. In Australia, ongoing archaeobotanical research is evaluating the scientific evidence for claims of farming on the continent while expanding knowledge of the diversity and resilience of plant economies across it for at least 65,000 years. Furthermore, archaeobotany can track plant use changes alongside broader changes in society, environment and economy to understand the causes and outcomes of such changes. For example, work in Africa is showing how colonialism and globalisation have led to the development of centralised pathological economies that undermine community resilience and wellbeing, providing a historical and empirical basis for challenging the status quo. While internal challenges for archaeology have slowed this research in Australia, its future is bright with every deepening partnerships across academic disciplines and with Indigenous knowledge holders.

Bio
Andrew Fairbairn is an archaeobotanist and archaeologist interested in the deep time history of food systems, including the origins and transformations of ancient agriculture, foraging practices and past anthropogenic landscape change. He studied at the UCL Institute of Archaeology in London before working at The Museum of London, Cambridge University, Australian National University and, since 2006, at UQ in Brisbane, Australia, where he is Professor of Archaeology. He has worked extensively in Turkey, where he is co-director of the Boncuklu Project, and has published research on ancient plant use in the UK, central Europe, Jordan, Papua New Guinea, China and Australia.

Dr Kamalesh Adhikari

Title
The challenges of accessing and researching Indigenous plants: An empirical investigation within and beyond the remits of Australian access and benefit sharing laws

Abstract
While research and bioprospecting activities on Indigenous resources continue to rise, concerns have deepened that Indigenous people are not receiving real and tangible benefits. This has led some scholars to question the role and effectiveness of access to genetic resources and benefit sharing laws. This paper argues that the problems that exist for Indigenous people are not confined to access and benefit sharing schemes. Rather, the question of whether or not access and benefit sharing laws provide benefits to Indigenous people largely depends on another equally important question: Have other laws in the same jurisdictions recognised Indigenous people's rights to their lands and resources? In developing this argument, the paper offers a detailed empirical investigation of an Australian native foods project that sought to research and explore the nutritional, sensory and bioactive properties of Burdekin plum through UQ. Scientifically known as Pleiogynium timoriense, Burdekin plum is an Australian native plant traditionally used and maintained by Indigenous people in North Queensland. The paper demonstrates that despite several efforts made by the university researchers and the Indigenous partner, the agreement to access and research the samples of Burdekin plum could not be signed. The problem was not with the relevant access and benefit sharing laws or the mutually agreed terms of access and benefit sharing. Rather, the problem was with Australia's native title law restrictions that continue to limit several Indigenous people's ability to harvest and use

resources for scientific research and development purposes. The paper concludes that future research should move beyond the remits of access and benefit sharing laws to explore what constraints exist on the scientific use of genetic resources, research collaboration and benefit sharing with Indigenous people.

Bio
Dr Kamalesh Adhikari is Research Fellow with the ARC Industrial Transformation Training Centre for Uniquely Australian Foods and Associate Research Fellow with the ARC Centre of Excellence for Plant Success in Nature and Agriculture at UQ. His current research focusses on socio-legal issues and concerns associated with the collection, use, and circulation of Indigenous plants, including traditional knowledge.

Friday Guest Speaker

Daniel Gschwind
Chair of Trade Investment and Queensland and Honorary Consul for Switzerland in Queensland

Bio
Daniel Gschwind was the CEO of Queensland Tourism Industry Council (QTIC) from 2001 to 2022, representing the industry in numerous committees and forums. In 2022, was appointed as Professor of Practice for the Griffith Institute for Tourism at Griffith University. He has been an Adjunct Professor at UQ since 2002. He is also a Director of Tourism Whitsundays, a member of the board of Jobs Queensland and the Chair of the Tourism Reef Advisory Committee of the Great Barrier Reef Marine Park Authority (GBRMPA), Chair of Queensland Music Trails (QMF) and is the Honorary Consul for Switzerland in Queensland. Earlier in his career Mr Gschwind was involved in yacht charter operations in the Mediterranean and the Caribbean before relocating to Australia where he completed an honours degree in economics at UQ. He worked as a senior economist for the Queensland Treasury for 6 years before taking on his tourism roles.

Session 5: Future materials

Professor Andrew Whitaker, Session moderator
Senior Group Leader, Whittaker Group, AIBN, UQ

Bio
Professor Andrew Whittaker's research aims to develop innovative solutions to major health and nanotechnology challenges. He is a scientific leader, is currently President of the Pacific Polymer Federation (2019–2022), Past-Chair of the Royal Australian Chemical Institute Polymer Division and has served on the Australian Research Council College of Experts. Professor Whittaker's work in synthesis and characterisation of polymeric materials has underpinned major development programs in several key areas. In the field of materials for photolithography this has been supported by funding from leading semiconductor companies Intel, Sematech, the Dow Chemical Company and Tokyo Electron America. Outcomes include novel high-index resists for 193nm immersion lithography, new concepts for design of non-chemically amplified resists for EUV lithography and development of the use of block copolymers for manufacture. In the field of biomaterials science, Professor Whittaker is most

	active in developing novel imaging agents for MRI, and introduced a new class of 19F polymeric agents. His team has several programs developing anti-fouling materials for medical devices. He is an expert in the fundamentals of diffusion process in complex solids, and has an international reputation in the field of NMR and MRI of polymeric systems.
	**Dr Nasim Amiralian**, Session moderator Senior Research Fellow, AIBN, UQ **Bio** Dr Nasim Amiralian is Group Leader of Bio-inspired Materials Research and Chair of the Gender Equity and Diversity Commission at AIBN, UQ. Her pioneering research uses a nanocellulose platform technology to develop innovative materials for diverse applications, including biodegradable packaging materials, protective medical textiles, and biocomposites. The application of nanocellulose for advanced materials is gaining interest internationally, and my vision is to capitalise on this momentum to spearhead research into new sustainable products that will have global impact. Dr Amiralian is a strong advocate for cultural diversity and equity and support staff and students to grow as more effective leaders and create social good. In recognition of her contribution to the field of nanomaterials engineering and research excellence, she has received a number of awards including The Eight Australian Women Who Are Shaking up the World Of Science (Marie Claire, 2020); one of Australia's Top 5 Scientists (ABC/UNSW, 2018); Queensland Women in STEM Prize- judges choice award (2017); Women in Technology Life Sciences and / or Infotech Rising Star Award (2016); AIBN Research Excellence Award (2016); a Class of 2014 Future Leader award and best poster prize at the Australian Nanotechnology Network ECR Entrepreneurship workshop (2015).
	**Professor Sagadevan Mundree**, Session moderator Head, School of Agriculture and Food Sustainability Faculty of Science, UQ **Bio** Professor Sagadevan Mundree is currently the Head of the School of Agriculture and Food Sustainability at UQ. Prior to joining UQ, he was the Director of the Centre for Agriculture and the Bioeconomy at QUT. He also served as a senior executive in the Queensland Department of Primary Industries and Fisheries where he led a team that was responsible for the Department's investments in research, development, and extension in all the primary industries of Queensland. He is a former academic from the University of Cape Town and served as Chief Executive Officer of South Africa's National Innovation Centre for Agricultural Biotechnology. He holds a PhD in molecular and cell biology, which he completed at Auburn University (USA) on a Fulbright Scholarship, an MBA from the University of Cape Town and is a Senior Executive Fellow of the Harvard Kennedy School. He is a member of the South African Academy of Science and served on the National Biotechnology Advisory Council.

Professor Alcides Leao
Department of Bioprocess and Bioengineering, School of Agricultural Sciences, UNESP

Title
The Circular Bioeconomy in the Development of Smart Biobased Materials

Abstract
Bioeconomy when harmonised with the circular economy is essential in future technologies. Renewable materials are the key pillar toward sustainability, helping to mitigate climate change and overcome environment degradation. Recently in addition to this broad concept, the biomass cascade represents an opportunity to develop smart materials applications made from several natural sources, including cellulose, hemicellulose, chitin, lignin, and their byproducts or residues from traditional processing industries. In this application can be listed sensors, actuators, energy storage, mimetism and tailor-made properties, biogenic composites, etc. Aiming to further improve functionality of renewable materials, hybrid composites in thermoplastics or thermosetting matrices can be reinforced or stressed in its properties generating high value materials for distinct applications, including, biomaterials, composites for ballistic application smart fabrics, etc. Their advantages are that they are biocompatible, sustainable, biodegradable, with high mechanical strength, lightweight and versatile modification behaviours. Smart materials will shape the future.

Bio
Alcides Lopes Leao is Full Professor, responsible for the areas of biomass, bioenergy and biobased materials, Department of Bioprocess and Bioengineering, School of Agricultural Sciences, Campus of Botucatu, UNESP, Brazil. Coordinator of the laboratory RESIDUALL – Laboratory of Solid Residues and Composites. He has published more than 150 papers in journals, 70 articles in newspapers and magazines, 35 books chapters and 4 books. Visiting professor at University of Wisconsin, Madison, USA in 1993 and at QUT in Brisbane, Australia from 2019 to 2024. Professor of the professional master's degree course promoted by Volkswagen AG, Autouni - Sustainable Technologies, Wollfsburg, Germany, 2005. Mentor at Stirling University, Scotland from 2020 to 2023. Coordinator of the Global Bioeconomy Alliance, UNESP (Brazil), TUM (Germany), UQ (Australia), UBC (Canada) and Nanyang Technological University (Singapore). Professor Leao has been an invited lecturer in more than 150 international conferences and lectures in more than 60 countries.

Dr Florian Graichen
General Manager, Forests to Biobased Products, Scion

Title
The biggest adventure of humanity

Abstract
Has the reality of climate change or earth overshoot days hit you – did you need the various global annual “once in a lifetime” events or were you aware before? Don’t take this personal – you are not alone. We are waking up to this inconvenient truth and as always are very slow to realise them and react. Working with future materials is not different to any other parts of our economy, society or environment – business as usual, solutions from the past and incremental change does not get us even near to solutions for the challenges that we are facing over the coming decades. Climate change or living beyond

our means are the challenge of our generation – they are global disruptors. I will share stories of success and hope and a different message – they are also the opportunity of our generation. There are enormous opportunities and rewards for the continents, countries and companies that are disruptors rather than disruptees.

Bio
Dr Florian Graichen is General Manager for Scion's bioproducts, bioenergy and biomanufacturing areas. These activities are directed at solving new product and process challenges and opportunities that arise through transition to a circular bioeconomy. In 2022, Dr Graichen was appointed as an Honorary Professor by the University of Waikato in the School of Engineering. He is board member of Packaging New Zealand and the Bioresource Processing Alliance. Florian also represents New Zealand on the Australian New Zealand and Pacific Islands Plastics Pact (ANZPAC) Collective Action Group. Additionally, he co-leads a Science for Technological Innovation National Science Challenge (SfTI) Spearhead around 3D and 4D Printing. Previously, he worked as Senior Scientist and Commercial Manager at VITO (Belgium) and CSIRO (Australia). Dr Graichen was born and grew up in Germany, but has been living in New Zealand and Australia for 20 years.

Professor Michelle Colgrave
Deputy Director (Impact), CSIRO Agriculture

Title
The Future of Food: Complementary Proteins

Abstract
As the global population surges past 8 billion and becomes increasingly wealthy its demand for animal protein, particularly red meat and dairy products grows exponentially. There are questions as to how these needs can be fully met in a carbon neutral world. In response to the growing demand for protein, technologists have been searching for cost-effective, resource-efficient and environmentally-friendly protein technologies and solutions that can support traditional industries or create new industries. Plant-based patties, lab-grown meat, microbially-brewed beverages... the options for protein are endless and ever-evolving. In this presentation, we will be discussing the latest developments in complementary, not alternative proteins, and how they are being used in the food industry today.

Bio
Professor Michelle Colgrave is the Deputy Director (Impact) in CSIRO Agriculture and Food, based at the Queensland Bioscience Precinct in Brisbane, Australia. Prior to taking on the Deputy Director role, she led the Future Protein Mission for CSIRO. Her scientific background is the application of proteomics, the study of proteins using mass spectrometry, to agriculture and food science to the benefit of human health – with a special focus on proteins involved in food intolerance and allergy as well as bioactive proteins that bring specific health benefits. Professor Colgrave is a Chief Investigator on the ARC Centre of Excellence for Innovations in Peptide and Protein Science. Prior to joining CSIRO, Professor Colgrave built a strong, international reputation for her studies in the structure and function of bioactive peptides, including the cyclotides. Her research, often applying innovative approaches, has been widely published in high impact journals (Nature, ACS Chemical Biology, Journal of Biological Chemistry, Biophysical Journal). Her findings

have gone beyond reporting molecular structures to uncovering the evolution and development of these peptides (PNAS, Nature Chemical Biology, Plant Cell). She was the editor of the book *Proteomics in Food Science: From Farm to Fork* aimed at introducing the application of mass spectrometry (MS) and proteomics to the food science and agricultural research communities.

Professor Bronwyn Laycock
Professor, School of Chemical Engineering, UQ

Title
Biodegradable and bioderived polymers and composites – materials of the future

Abstract
Authors: Bronwyn Laycock, Steven Pratt and Paul Lant
Given the greater global awareness of environmental impacts of plastics and the need to develop alternative materials from renewable natural resources, there has been an increasing drive over recent years to develop biobased and biodegradable polymers and bio-composites, especially those produced from agro-industrial waste and byproducts. This presentation will provide a brief introduction to the field as well as discussing some of the critical aspects to be considered as we accelerate the development of these novel alternative materials. In particular, the focus will be on the family of polyhydroxyalkanoates – bacterial polymers that are naturally produced as carbon storage materials in a very wide range of microorganisms. These natural polymers are of great current interest due to their biodegradability under ambient conditions as well as their thermoplastic nature and their material properties which in many ways are comparable to current commodity polymers. However, there are some barriers to their use, such as brittleness and melt thinning behaviour, and this presentation will cover some of the modification strategies that we have adopted to date.

Bio
Professor Bronwyn Laycock has a diverse background in translational research, working not only in academia but also in industry and as a consulting chemist, as well as at CSIRO. Her research activities have ranged from bio/degradable polymers, composites, organic and organometallic synthesis, waste conversion technologies, and pulp and paper chemistry, to general polymer chemistry. She is currently working across a range of projects with a focus on materials for circular economy applications and management of the transition to the new plastics economy. The application areas in her research program include biopolymers (particularly polyhydroxyalkanoates), polymer lifetime estimation and end-of-life management/conversion technologies, biocomposites, controlled release matrixes for pesticide and fertiliser applications, polyurethane chemistry, polymer foams, biodegradable packaging, carbon nanofibre production and peptide based conducting nanowires. She has a strong history of successful commercialisation and impact, being a co-inventor on CSIRO's extended wear contact lens program (recognised as it fourth most significant invention) for which she was awarded a joint CSIRO Medal for Research Achievement 2009. As a Project Leader and Deputy Program Leader within the CRC for Polymers, she also managed a project that delivered an oxodegradable thin film polyethylene that was commercially licenced by Integrated Packaging. This work earned the team a Joint Chairman’s Award for research / commercialisation (CRC for Polymers) and an Excellence in Innovation Award (CRC Association).

Dr Peter Harris
Postdoctoral Research Fellow, University of Southern Queensland

Title
Integrated closed loop organic waste management

Abstract
Integrated, closed loop approach can help industry to make optimal use of their organic waste to produce energy and nutrients in a synergistic cycle of profit-making processes where the by-product of each process becomes the feedstock for another. This presentation will provide an overview and present findings of 2 areas of closed loop approaches. The first is the development of an innovative online Anaerobic Digestion Assessment Tool, which aims to provide a quick, economic feasibility assessment for industry partners interested in anaerobic digestion, as well as identifying co-digestion opportunities in the area. Secondly, to improve the circularity and economics of biogas facilities we are investigating the production of a granulated biofertiliser which is chemically balanced and able to be applied on land. Our glasshouse and field trials have shown biofertilisers improve soil-nutrient status and produces higher crop yields compared to urea. The work will improve understanding of the fertiliser replacement value of organic waste.

Bio
Dr Peter Harris is a postdoctoral research fellow at the University of Southern Queensland's (USQ) Centre for Agricultural Engineering (CAE) in the Energy and Bioresource Recycling team. His principal expertise is in anaerobic digestion with over 13 years' experience working with Australian agricultural industries in this regard. During this time his involvement has been critical to several works, including the development of 'ADAdvisor', an online, techno-economic feasibility assessment tool for prospective anaerobic digestion installations, which aims to increase adoption of anaerobic digestion technologies while further providing education and data collection; working with regional councils to develop business cases for advanced waste management services; working with the region to advance agri-food waste management; and, working with industry to develop an advanced waste management plan for hospital waste. Dr Harris's interests include waste management, sustainability, circular economy principles and renewable energy, and he hopes to combine these interests to increase adoption and utilisation of anaerobic digestion in developing nations.

Session 6: Critical minerals – An opportunity for the bioeconomy in the mining sector

Dr Denys Villa Gomez, Session moderator
Advance Queensland Industry Research Fellow, AIBN, UQ

Bio
Dr Denys Villa-Gomez is a Senior Lecturer at the School of Civil Engineering. She obtained her PhD at the Institute for Water Education (UNESCO-IHE), The Netherlands in 2013. Before joining UQ, she was docent at the National Polytechnic Institute (UPIIZ-IPN), Mexico, where she developed Bachelor of Science courses for careers in environmental engineering and food engineering bioprocess. She leads research in environmental engineering, focusing on the development of sustainable technologies for the treatment and recovery of valuable resources from wastewater and solid waste, where she works with METS sector and government stakeholders. Her topics of interest include circular economy, extraction of critical metals through biotechnology processes, anaerobic digestion for extraction of bioenergy and high-value compounds, waste / wastewater treatment, optimization of bioreactors systems, use of genomics and proteomics tools for improving bioengineered systems. She has published over 35 peer-reviewed journal and conference papers in high impact factor journals and has expert and advisor roles such as editor in leading journals and member of scientific committees.

Professor Peter Erskine, Session moderator
Director, Centre for Mined Land Rehabilitation, UQ

Bio
Professor Peter Erskine leads research into the environmental impacts and mitigation impacts from mining on ecosystem function. One of the key areas of his research activities has been to develop a robust set of monitoring methods to ensure mine impacts and rehabilitation outcomes are quantified and understood across diverse ecosystems and climatic zones. Part of this work also includes advancing spatial analysis and unmanned aerial systems (UAS) to quantify vegetation condition and ecosystem function across large spatial scales. We also explore the discovery and use of metallophyte (metal tolerant) plants in mine site rehabilitation and their potential for phytomining. By utilising unusual hyperaccumulator plants that have evolved to absorb and store high concentrations of minerals we assess the application of the plants under a range of environmental conditions. He is currently the leader of the Ecosystem Assessment, Restoration and Resilience Group within UQ's Centre for Mined Land Rehabilitation (CMLR), which is part of the SMI. Since completion of his PhD he has worked with non-government organisations, as an environmental consultant and within the university system. Over the last 2 decades he has conducted research work on landscape restoration and mine rehabilitation. He has conducted this research in Australia, Papua New Guinea, Malaysia, Myanmar, New Caledonia, Indonesia, Laos, Sierra Leone, Uganda, Vietnam and Zambia. He has also trained students from a range of countries and taught undergraduate courses on restoration ecology and plant biology.

Professor Rick Valenta, Session moderator
Director, Sustainable Minerals Institute (SMI), UQ

Bio
Professor Rick Valenta leads research aimed at improving the discovery, mining and processing of hydrothermal ore deposits. His areas of focus include structural geology, geophysics and ore deposit geology, with an overall theme of better understanding the underlying processes, which lead to the localisation and characteristics of these deposits. Professor Valenta also has a strong focus on development of 4D mineral systems models from deposit to region scales, using these models to improve targeting techniques, better formulate geological and resource models, and inform prediction of mineral processing performance. Trained as a geologist, he worked for a short time in petroleum exploration in Western Canada before coming to Australia to complete a PhD on the George Fisher Zn-Pb-Ag deposit in the Mount Isa region. He then spent 5 years as a lecturer at Monash University in an industry-supported role aimed at developing the science and practice of structural interpretation of geophysical data. During this period, Professor Valenta was involved in the development of very successful industry training programs and a significant number of publication and software outputs. He then spent 23 years in industry roles including Chief Geologist, Chief Operating Officer, and multiple CEO roles. Companies and exploration teams under his direction have been involved in a significant number of mineral discoveries of copper, uranium and gold, as well as several transformative company transactions. In his career, Professor Valenta has held senior executive roles in teams that have raised over $150 million in venture capital investment, leading to the creation of over $2 billion in shareholder value. He is also a Fellow of the AusIMM, a practising member of the Association of Professional Geologists of Ontario (APGO), a member of the Geological Society of Australia, the Society of Economic Geologists, and the Australian Institute of Company Directors. He is Chair of the Research Committee of the Queensland Exploration Council. Effective January 2022, Professor Valenta was appointed to the new role of SMI's Deputy Director – Production, a key operational and strategic leadership role with responsibility for WH Bryan Mining Geology Research Centre (BRC), Julius Kruttschnitt Mineral Research Centre (JKMRC) and Minerals Industry Safety and Health Centre (MISHC).

Nicholas Gurieff
Principal Advisor, Mine Closure R&D, Rio Tinto

Title
Biosolutions as catalysts for critical mineral valorisation during mine closure

Abstract
Mine closure is a vitally important part of the mining life cycle. Closure can be a complex process that is inherently costly but aims to treat wastes that are left at sites after active mining is finished to limit the impact these have on the environment and local communities. However, post-mining wastes can have significant amounts of value remaining in them and the valorisation of this value can not only help off-set some of the costs of closure, but also reduce the risk these wastes present in the longer term. While valorisation of these waste resources has been done in the past, these processes are commonly energy and chemical intense which poses a challenge at closed sites where access to large amounts of energy and chemicals is not always possible. In recognition of this, there is an increasing number of biosolutions that have the potential to deliver value but without the energy and chemical footprint of

traditional technologies. This presentation will discuss the potential value biosolutions can deliver for mine closure and their role in supplying critical minerals for the low carbon economy of the future.

Bio
Nick Gurieff is a process engineer who has worked in the water treatment and waste valorization space for the past 15 years. After completing a MSc in biotechnology at DTU in Copenhagen, Denmark he undertook a PhD at UQ investigating biopolymer production from industrial wastewaters. This has led to a passion for "waste" resource upcycling and a career in Denmark, Sweden and Australia. Currently, Mr Gurieff is leading R&D programs with Rio Tinto Closure investigating sustainable mine water treatment and valorization along with building a stronger biotechnology based approach to challenges related to mine asset closure and rehabilitation.

Dr Anna Kaksonen
Group Leader – Industrial Biotechnology, Environment, CSIRO

Title
Biotechnical extraction and recovery of critical minerals from low grade ores and wastes

Abstract
Biomining utilises the activity of microorganisms to extract and recover metals from solid materials. It has been applied for decades at an industrial scale for the bioleaching of copper from sulfidic ores, and the biooxidation of refractory sulfidic gold ores. There is growing interest in exploring the potential of biomining for extracting and recovering value from various wastes and targeting new types of critical commodities, such as rare earth elements and lithium. Biomining is attractive for low-grade and complex ores and wastes, which may not be economical to process through traditional metallurgical pathways; as well as for feedstocks containing penalty elements, such as arsenic. Biomining is typically carried out at ambient pressures and relatively low temperatures, providing opportunities to reduce the energy consumption and the carbon footprint of process compared to conventional hydrometallurgical and pyrometallurgical operations. This presentation gives an overview of biomining mechanisms, microbes and engineering applications and outlines some case studies.

Bio
With background in environmental engineering and biotechnology, Dr Kaksonen develops biotechnological processes for environmental and industrial applications in the mining, energy, water supply, waste and wastewater treatment industries to improve sustainability. Research topics of special interest have included biomining of low-grade ores and wastes, biofuels, bioremediation of contaminated sites, wastewater treatment and circular economy.

Dr Denise Bevilaqua
Vice-Director, Institute of Chemistry, UNESP

Title
Trash or Treasure? Biomining of critical minerals

Abstract
The presentation examines the innovative and environmentally sustainable approach of bioleaching for the recovery of critical metals. In a world characterised by increasing demand for these metals due to their indispensable role in modern technologies, their scarcity and conventional extraction methods' ecological impact have sparked interest in alternative techniques. Bioleaching, a well established process for recovery of low grade metals, has emerged as a promising solution. This presentation highlights the key principles of bioleaching, emphasising the role of microorganisms in liberating metals from complex ores besides electronic waste. The presentation also discusses the advantages of bioleaching and challenges associated with the process. Some results from our group of investigations are presented. The significance of ongoing research in this field and its potential to reshape the critical metals' extraction landscape, transforming what was once considered 'trash' into valuable 'treasure' through sustainable technological advancements are discussed.
Bio
Professor Bevilaqua holds a BSc in chemistry (1989), MSc (1999) and a PhD in biotechnology from UNESP. She is currently a full-time professor (2011) at the Biochemistry and Organic Chemistry department of UNESP. She has extensive experience in microbiology applied to biomining and implementation of biotechnological process to mineral processing, reuse of mineral tailings. She has also worked in the Tampere University of Technology (2008) as a visitant researcher. She pioneered the electrochemical study of mineral in the presence of bacteria since 2003, joining 2 different areas: electrochemistry and microbiology. Professor Bevilaqua has established long-term collaboration with Vale S.A, a Brazilian multinational corporation engaged in metals and mining, and the Itatijuca Biotech, a startup focused on developing and implementing the use of microorganisms in industrial processes with emphasis on mining. These scientific and applied approaches have led to the filing of 3 patents along with the publication of 36 papers, and 5 book chapters (866 citations, h-index 16) and 34 papers in conference proceedings. Professor Bevilaqua serves as reviewer for distinguished journals of the field, such as Hydrometallurgy, Chemosphere, Applied Biochemistry and Biotechnology, Minerals Engineering.

Dr Neville Plint
Adjunct Professor, UQ

Title
Mining’s future is biotechnology

Abstract
Mining's future lies in biotechnology, a revolutionary approach that can help us navigate the pressing challenges posed by climate change and the transition to a sustainable, net-zero world. The 2023 Intergovernmental Panel on Climate Change (IPCC) report serves as a

stark reminder of the urgent need to address climate change. To meet the ambitious net-zero targets set by governments and corporations for 2050, we must reimagine how we obtain the essential resources for our global economy. The current model, which relies heavily on carbon-based energy sources and conventional mining practices, is no longer sustainable. The shift towards renewable energy sources such as solar and wind, accompanied by battery storage, is pivotal in our fight against climate change. However, this transition demands a substantial increase in the supply of metals, including precious metals and rare earths. To achieve this, we must confront complex social, environmental, and governmental challenges associated with mining. Moreover, the growing demand for metals required for renewable energy will outpace the supply of these metals, creating additional challenges to meeting net-zero targets. What is required is not merely replacing old methods with new ones, but a paradigm shift throughout the entire system. We need a mining technology that leaves no environmental or social footprint and contributes to environmental regeneration. Biotechnology is the key to making mining more sustainable and aligned with our climate goals. Biotechnology offers a promising pathway to address the challenges posed by the transition to a sustainable, net-zero future. By harnessing the power of microorganisms and advanced biotechnological techniques, we can revolutionise the way we obtain essential resources while minimising environmental and social impacts. Embracing biotechnology in mining is not just a choice; it's a necessity if we are to achieve our 2050 goals and combat the effects of climate change effectively.

Bio
Dr Neville Plint holds a BSc Honours, PhD and MBA (Distinction), from the University of Witwatersrand in Johannesburg, and brings extensive leadership experience and a deep understanding of the mining sector having worked for 20 years at Anglo American in South Africa. He was Professor and Director of SMI at UQ and Managing Director of JKTech from 2016–2022. His focus at SMI was to build a multidisciplinary team of researchers that worked collaboratively to identify opportunities for the sustainable supply of minerals required for a sustainable future. His career has focused on delivering improved operational performance on mining sites by developing and implementing new technologies, while establishing a global network of research professionals in academic institutes, mining companies and research organisations. He is currently Chief Scientist at Anglo American and an adjunct professor at UQ and honorary professor at the University of Cape Town.

Professor Gordon Southam
Professor, Geomicrobiology, School of the Environment, UQ

Title
Biotechnology and mining of critical elements.

Abstract
Biotechnology has the potential to positively impact processes across the entire mining lifecycle from prospecting / exploration, to development, extraction, and closure and reclamation. The specific, genetic responses of

	bacteria to metals, covering nearly the entire periodic table provides metagenomic targets that could provide long-lived signatures of metals. The role of biology in development, referring construction of a mine site will become increasingly important as biotechnology is increasingly applied to mining. The classical role of biotechnology in metal extraction relates primarily to copper bioleaching or to mineral dissolution promoting the recovery of refractory gold. However, metal recovery has the potential to become increasingly important in mining, in particular when metal specific processes can be identified. With grades decreasing and critical metal targets being discovered in mine waste, waste to resource opportunities are becoming increasingly viable, reducing environmental impact while increasing metal recovery. **Bio** Professor Southam is a Professor in Geomicrobiology. He is an interdisciplinary researcher who crosses the traditional boundaries between biological and geological sciences to examine bacterial transformations of materials composing the earth's crust, and the impact these transformations have had over geologic time. Field sites have ranged from Yellowstone National Park, to Axel Heiberg Island in the Canadian high arctic, to the ultradeep gold mines in the Republic of Southam Africa (up to 4 km below land surface, to the Amazon Basin). Following his appointment as a Canada Research Chair in Geomicrobiology and Director of Environment and Sustainability at Western University, Canada, Professor Southam has moved to UQ where he is leading projects on mineral carbonation, using acid generating bacteria to enhance weathering of ultramafic mine waste, promoting mineral carbonation (CO2 sequestration): Bioremediation of iron mine sites, by enhancing the biogeochemical cycling of iron to promote the formation of ferruginous duricrusts (canga), and bioleaching; focussing on low-grade copper in arid through tropical ecosystems (Australia and Brazil); Gold exploration, examining the fundamental roles that bacteria play in catalysing the formation of placer gold.

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