Biomass Biorefinery Network

# 4th BBNet Conference

## The future prospects for biorefining: Feedstocks, technologies and products

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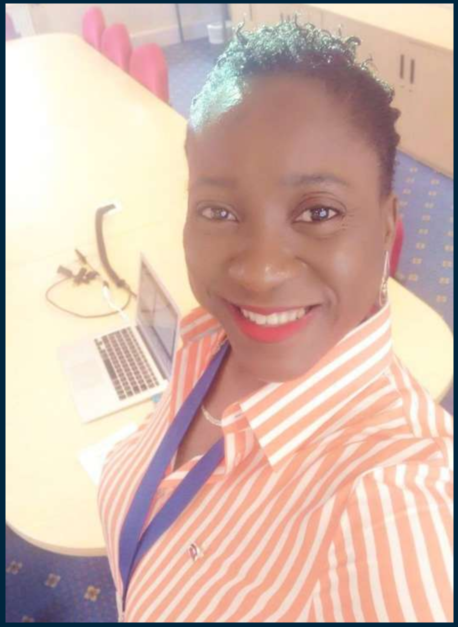
# The Future Prospects for Biorefining: Feedstocks, Technologies & Products

## 4th BBNet Conference Presenter
## 15th – 17th October 2025



Maureen Chiebonam Okibe
Academic Researcher
Chemical and Process Engineering Research (PhD)
University of Surrey

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# Acknowledgements

Madeleine Bussemaker

Franjo Cecelja


Michael Short

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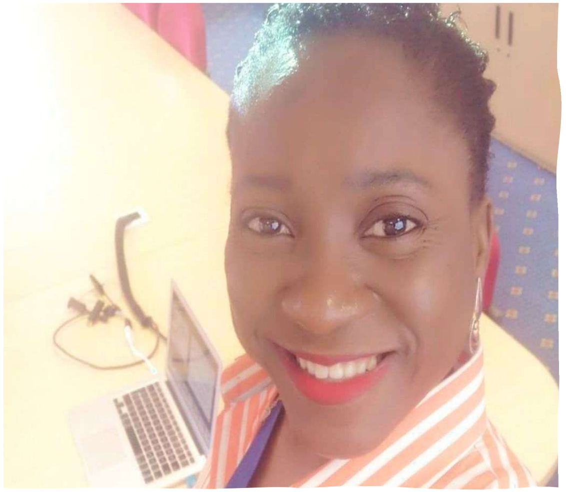


Maureen Chiebonam Okibe

BB Net Biomass Biorefinery Network

# Influence of Bioeconomy Policies on Beet and Cane Valorisation

Carbon-depleting & renewable Cash Crops


**Sugar Beet and Sugarcane Plants**

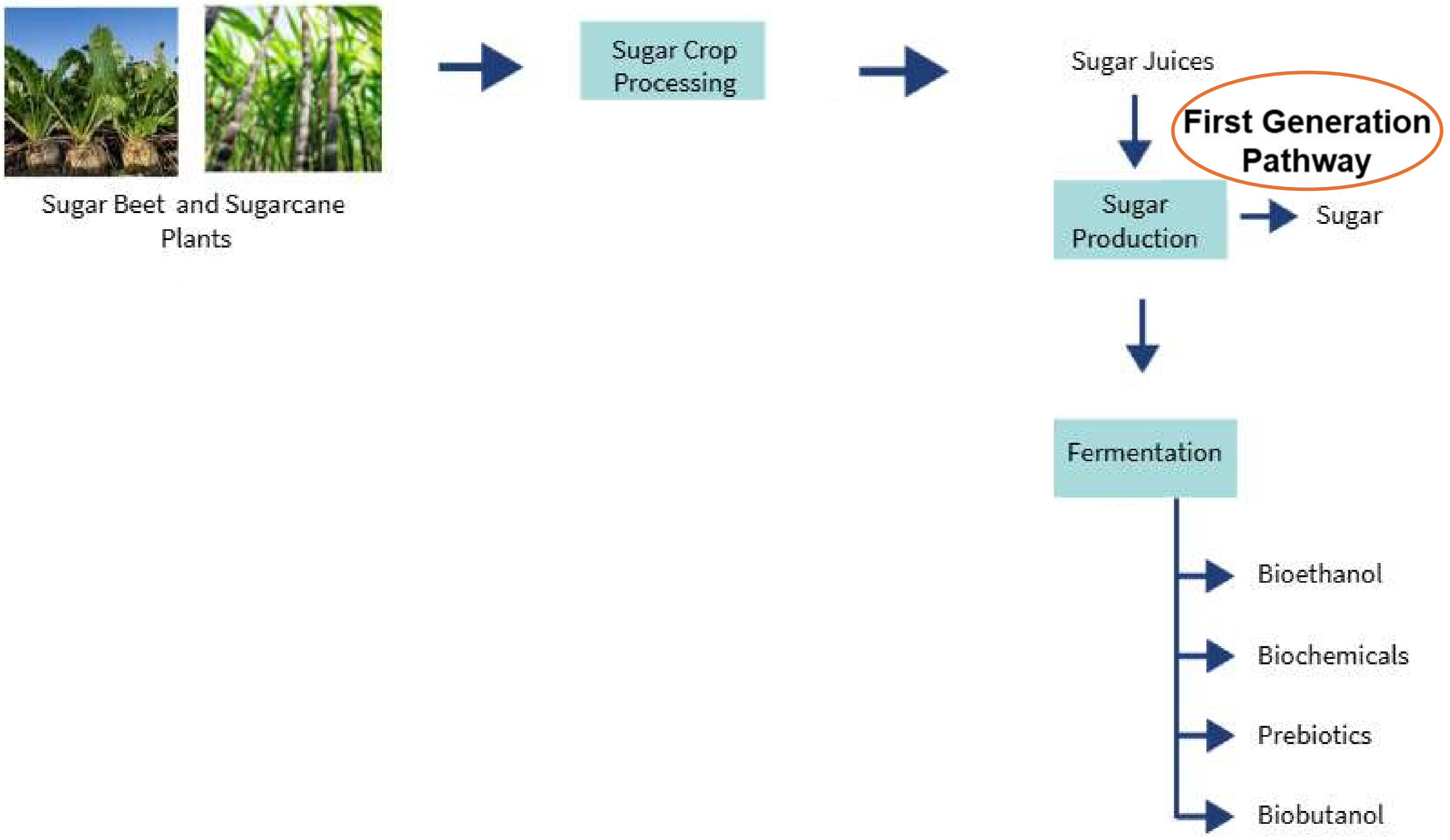
**Gikonyo et al., 2020, Martinez-Hernandes et al., 2018; Muir & Anderson 2022, Usmani et al., 2022**

To use classification methodology when:

- Simplifying cane and beet biorefining

- Assessing the influence of regional bioeconomy policies on cane and beet valorisation

# Classification of Beet and Cane Valorisation

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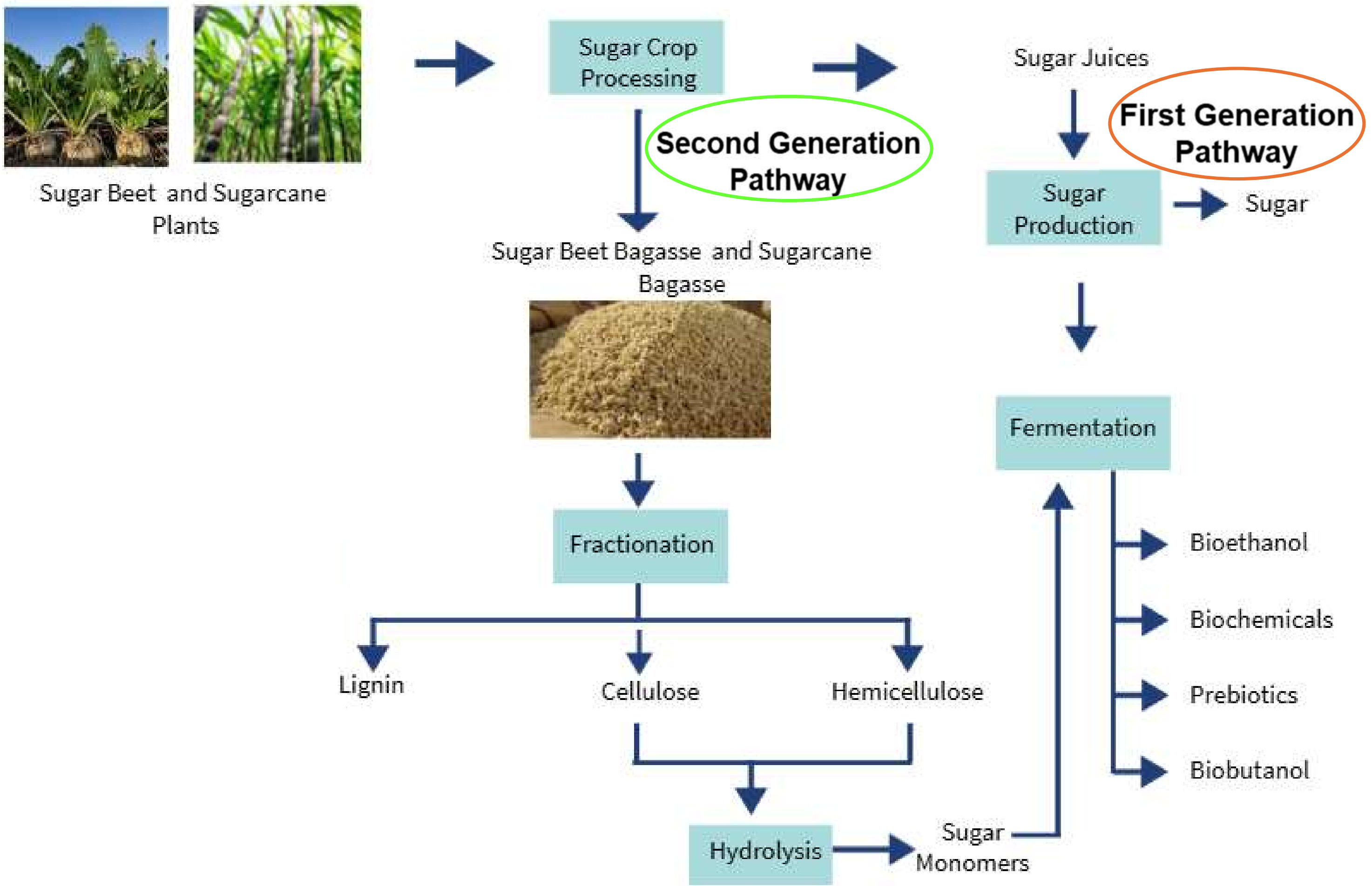


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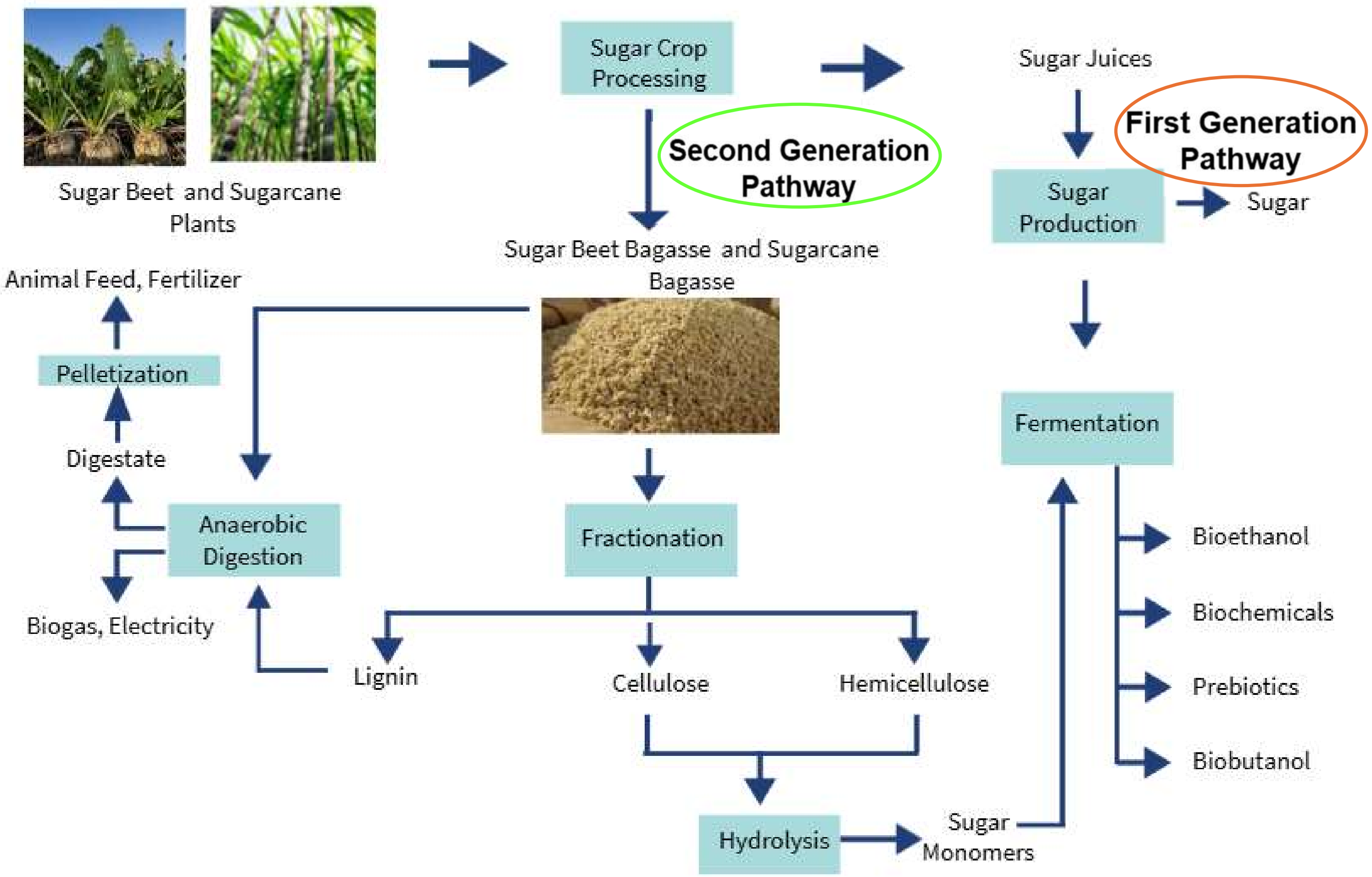
# Classification of Beet and Cane Valorisation

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# Classifications by Geo-spatial Landscapes, Conversion Technologies and Level of Regional Bioeconomy Policies

| Classifications | Americas | | | | Africa | | | Asia | | | | Rest of the World | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sub-Saharan Africa (SSA) | | Non-Sub-Saharan Africa | | | | | | |
| | Caribbean Islands | North America | South America | Central America | West, East & Central Africa | Southern Africa | North Africa | South Asia | South West Asia | East Asia | South East Asia | Oceania | EU |

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| *Traditional Technologies* | Combustion & Cogeneration | ✓ | ✓✓✓ | ✓✓✓ | ✓✓ | ✓ | ✓✓ | ✓✓ | ✓ | ✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓✓ |
| | Agricultural Applications | ✓ | ✓✓✓ | ✓✓✓ | ✓✓ | ✓ | ✓✓ | ✓✓ | ✓ | ✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓✓ |
| | Mechanical & Physiochemical | ✓ | ✓✓✓ | ✓✓✓ | ✓✓ | ✓ | ✓✓ | ✓✓ | ✓ | ✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓✓ |
| *Newer Technologies* | Anaerobic Digestion | × | ✓✓✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ | × | ✓ | ✓✓ | ~ | ✓✓✓ |
| | Pyrolysis & Gasification | × | ✓✓✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ | × | ✓✓ | ✓✓ | ~ | ✓✓✓ |
| | Biochemical Process & Hydrolysis | × | ✓✓✓ | ✓✓ | ✓ | × | ✓ | ✓ | ~ | × | ✓✓ | ✓✓ | ~ | ✓✓✓ |
| | Hydrothermal Liquefaction | × | ✓✓✓ | ✓ | ✓ | × | ✓ | ✓ | ~ | × | ✓✓ | ✓✓ | ~ | ✓✓✓ |

Minimal (✓), Average (✓✓), Comprehensive (✓✓✓), Inexistent (×), Inconsistent (~)

# Classifications by Geo-spatial Landscapes, Conversion Technologies and Level of Regional Bioeconomy Policies

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| | Hydrothermal Liquefaction | × | ✓✓✓ | ✓ | ✓ | × | ✓ | ✓ | ~ | × | ✓✓ | ✓✓ | ~ | ✓✓✓ |
| *Bioeconomy Driver* | Level of Regional Bioeconomy Policies | ✓ | ✓✓✓ | ✓✓ | ✓ | × | ✓ | ✓ | ~ | × | ✓ | ✓ | ~ | ✓✓✓ |

Minimal (✓), Average (✓✓), Comprehensive (✓✓✓), Inexistent (×), Inconsistent (~)

# Summary and Conclusion

Usefulness of Classification Methodology in Cane and Beet Biorefining

- Simplifies the biorefining knowledge
- Identifies gaps and trends, providing insights for decision making
- Provides qualitative assessment of bioeconomy drivers, i.e. Regional Policies, Processing Technologies

# Recommendation and Future Work

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FORM FUNCTIONAL BIOECONOMY ALLIANCES WITH SSA NATIONS

GLOBAL MACRO-ECONOMIC METRICS

# Gratitude

Thank you ALL for your attention

'Daalu nu'.

Questions?
Suggestions…
Contributions…

BBNet Conference 16th October 2025

# Engineering division of labour in *Yarrowia lipolytica* for polysaccharide degradation

**Eliza Atkinson**

ea2915@ic.ac.uk

Department of Bioengineering
Imperial College London

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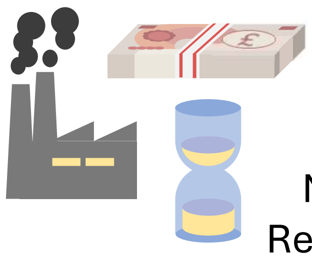
# Consolidated bioprocesses are essential for next-generation biotechnology

Goal: Reducing the cost of bioproduction by removing reliance on unsustainable high-demand feedstocks

***Raw biomass***

Abundant
Cheap
Sustainable



Time
Money
Resources

***Processed feedstocks***

Competition for use in other industries

**TRADITIONAL BIOTECH PRODUCTION**

Requires processed substrate

***Product***

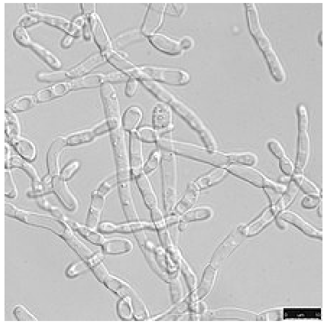
**CONSOLIDATED BIOPROCESS**

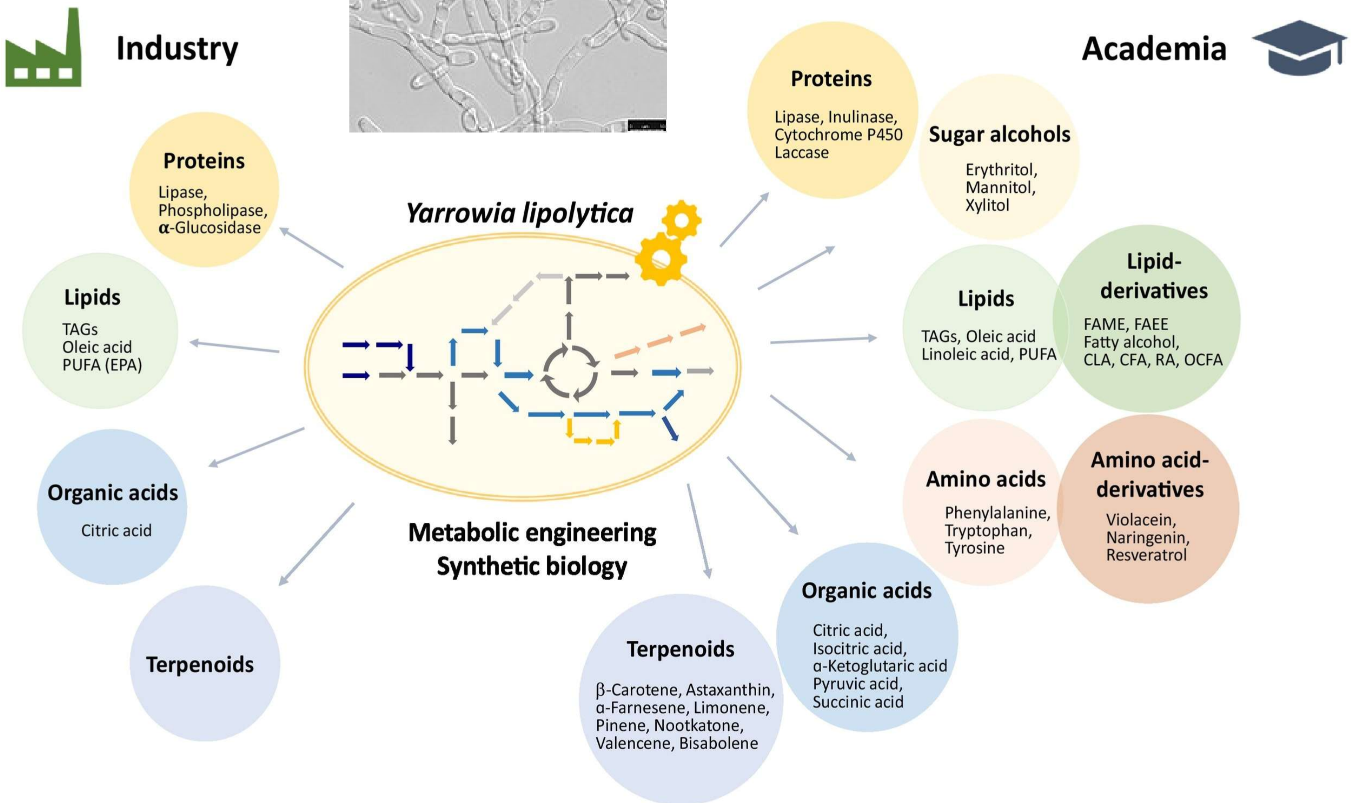
Processes complex substrate

***Product***

# *Yarrowia lipolytica*

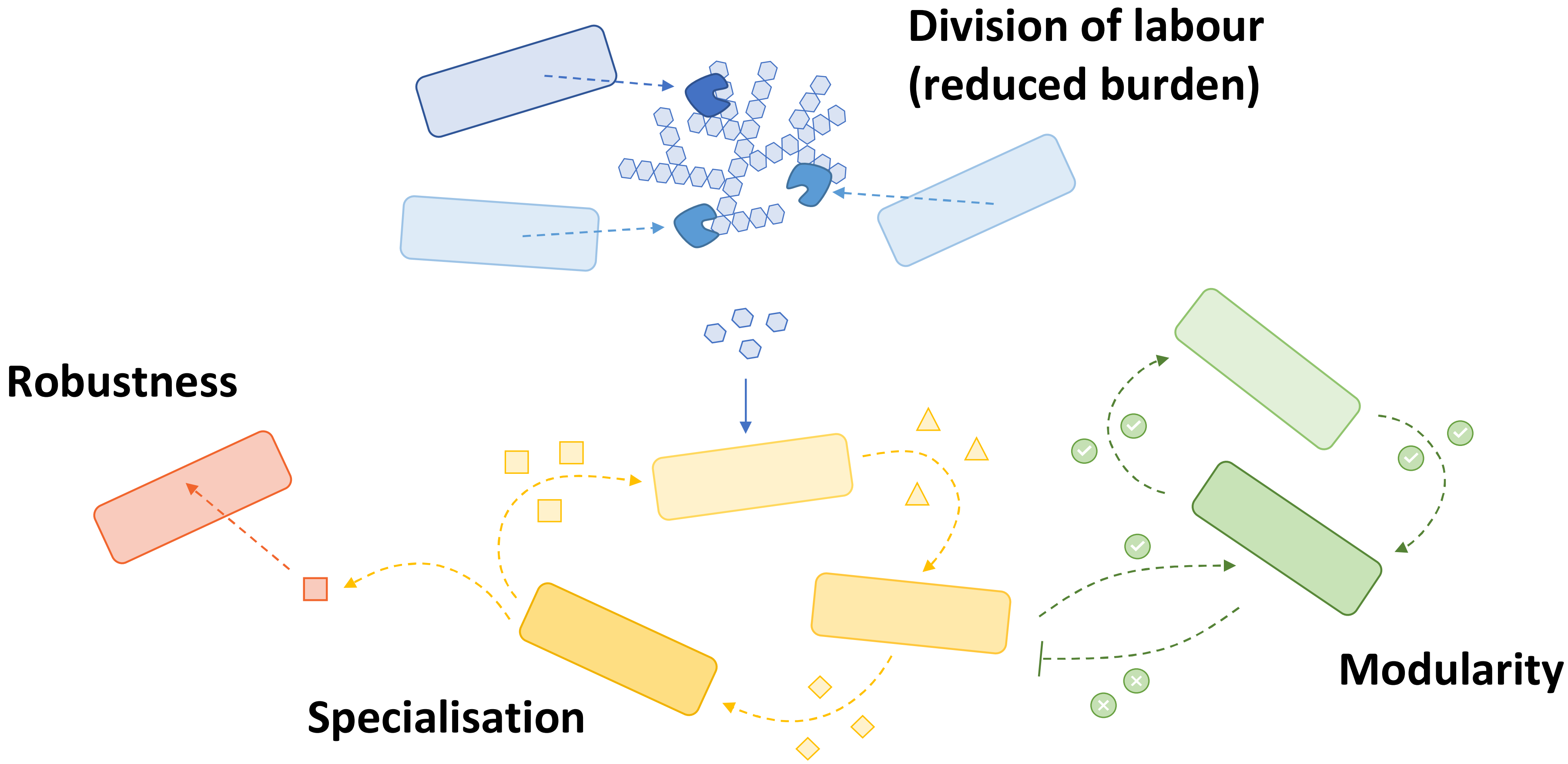
- Good host for heterologous protein expression and high-value production
- High secretory capacity
- Wide range of substrates already. Previously engineered to degrade:
  - Starch
  - Inulin
  - Cellulose
  - Xylan






*Park & Ledesma-Amaro. 2022.Trends in Biotechnology.*
41242-254 DOI: (10.1016/j.tibtech.2022.07.0060)

# The benefits of living together



# Rational design of DOL in the cooperative degradation of starch and xylan

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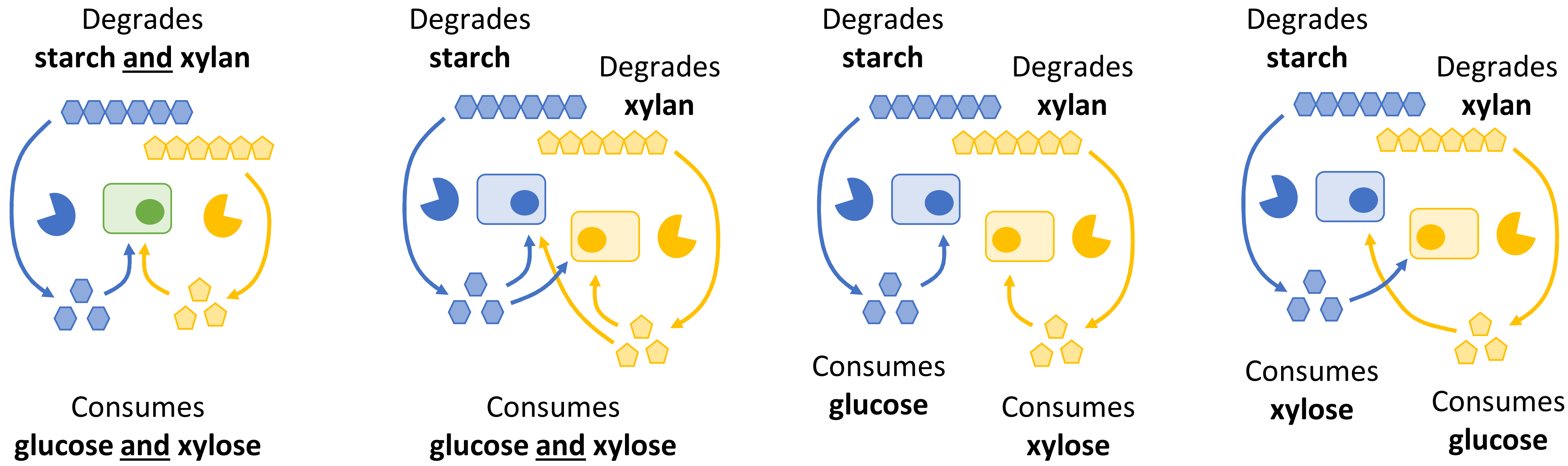
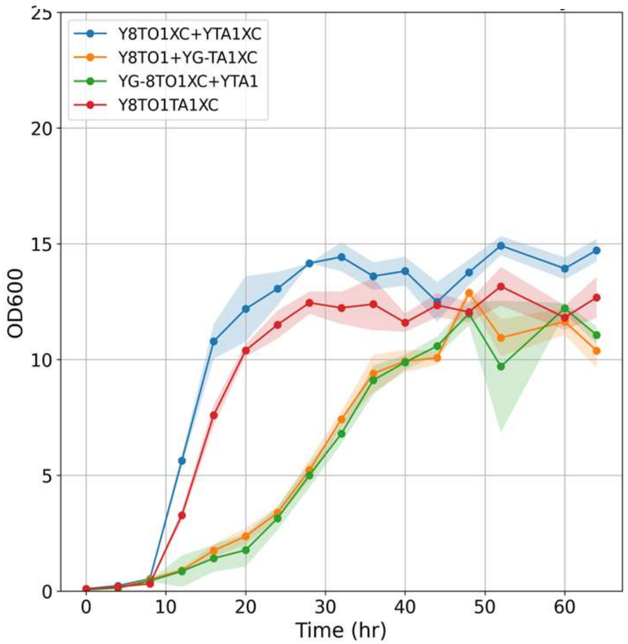
# Designing DOL between starch and xylan degradation




| Monoculture | Generalist consumer | Orthogonal specialist | Cross-feeding specialist |
|---|---|---|---|

# Growth of DOL strategies on starch + xylan

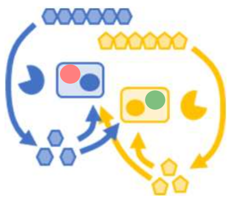
0.5% starch + 0.5% xylan

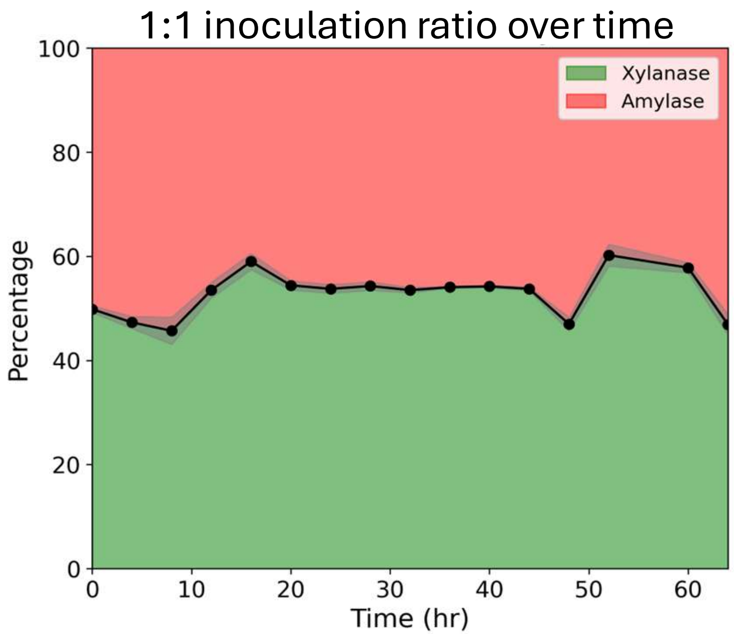


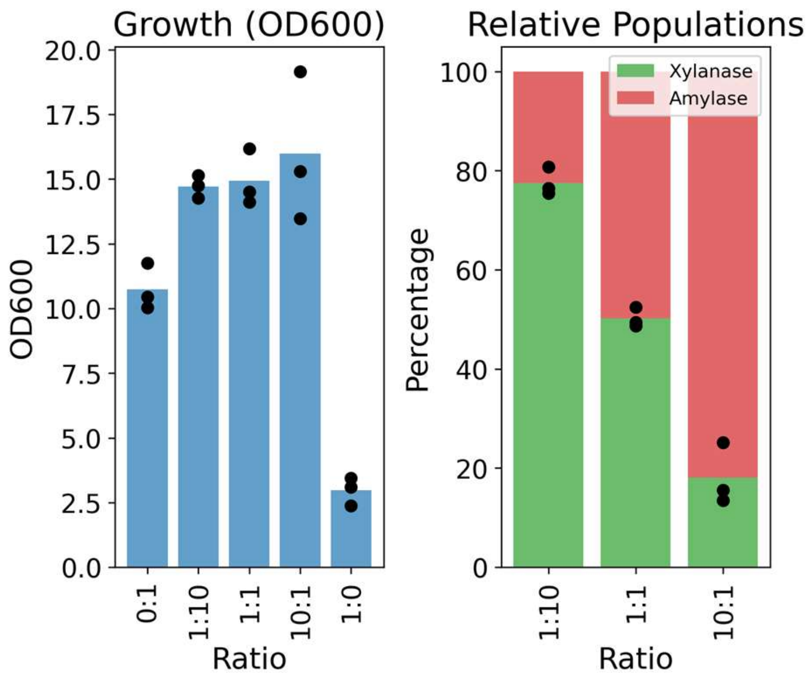

| Monoculture | Generalist consumer | Orthogonal specialist | Cross-feeding specialist |
|---|---|---|---|

# Generalist consumer consortium

## Maintains a stable ratio



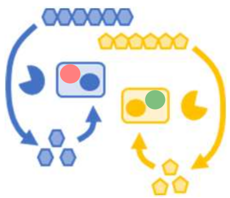


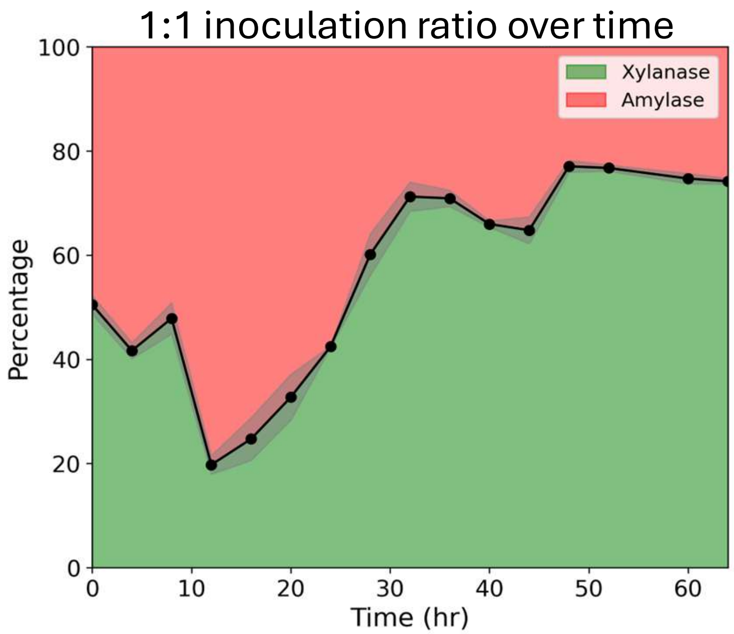



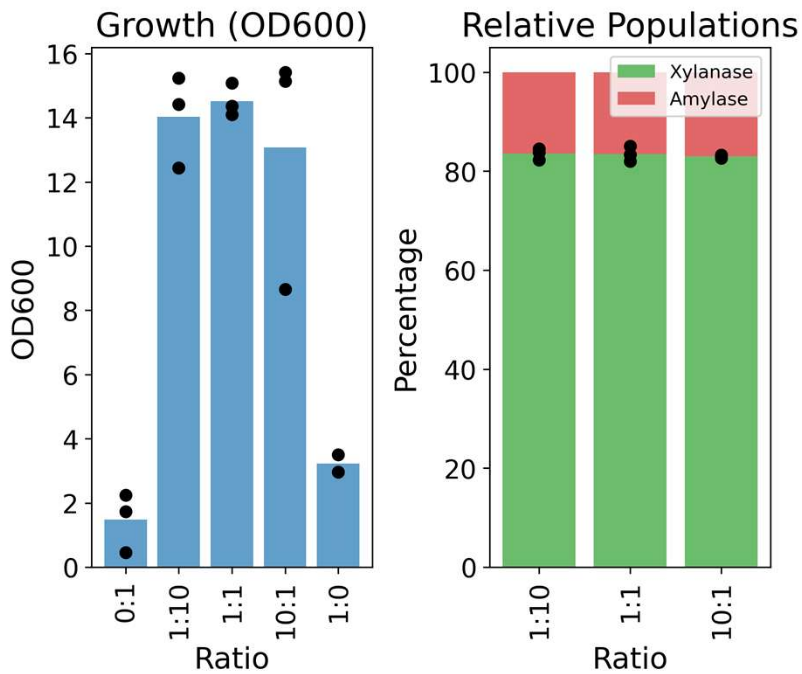

Monoculture | **Generalist consumer** | Orthogonal specialist | Cross-feeding specialist

# Orthogonal specialist consortium

**Favours the xylanase-xylose strain**



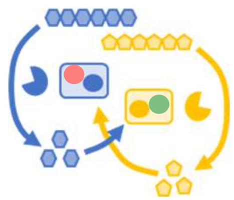


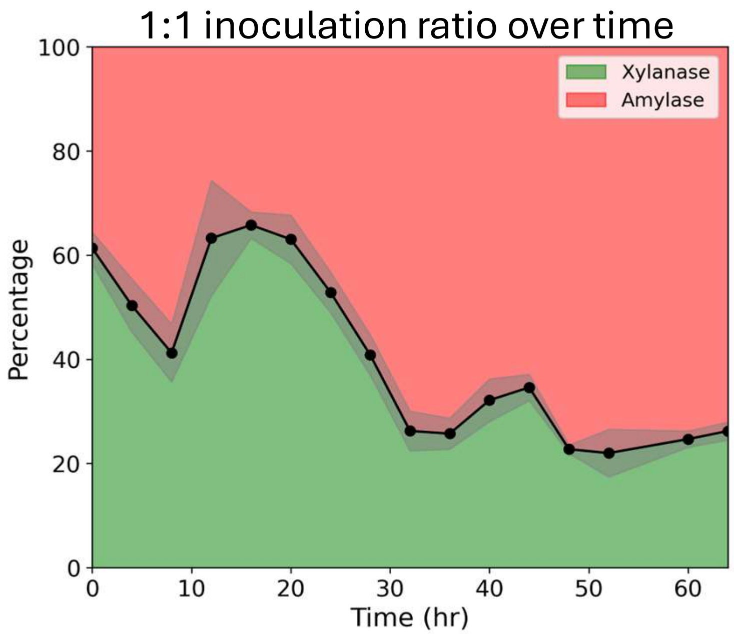



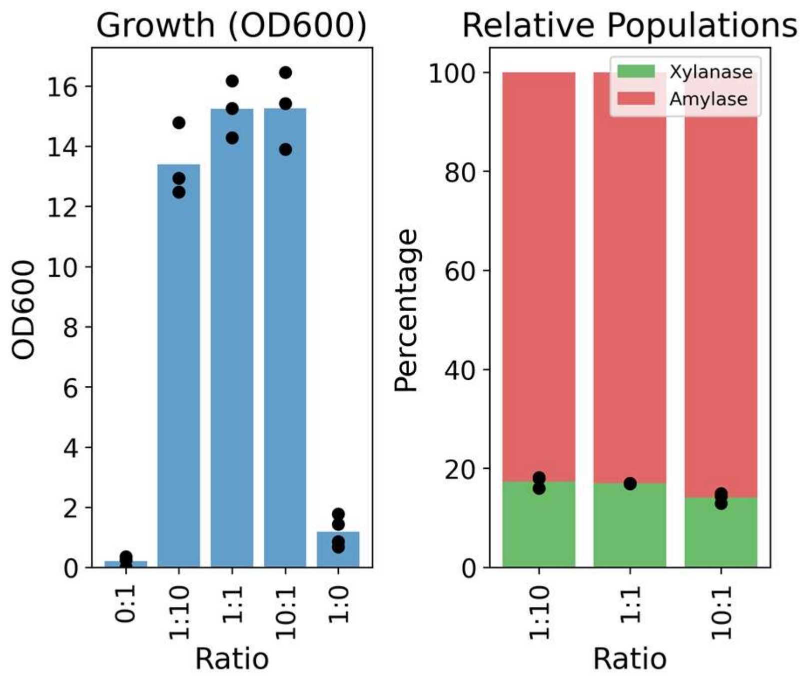

Monoculture | Generalist consumer | **Orthogonal specialist** | Cross-feeding specialist

# Cross-feeding specialist consortium

**Favours the amylase-xylose strain**

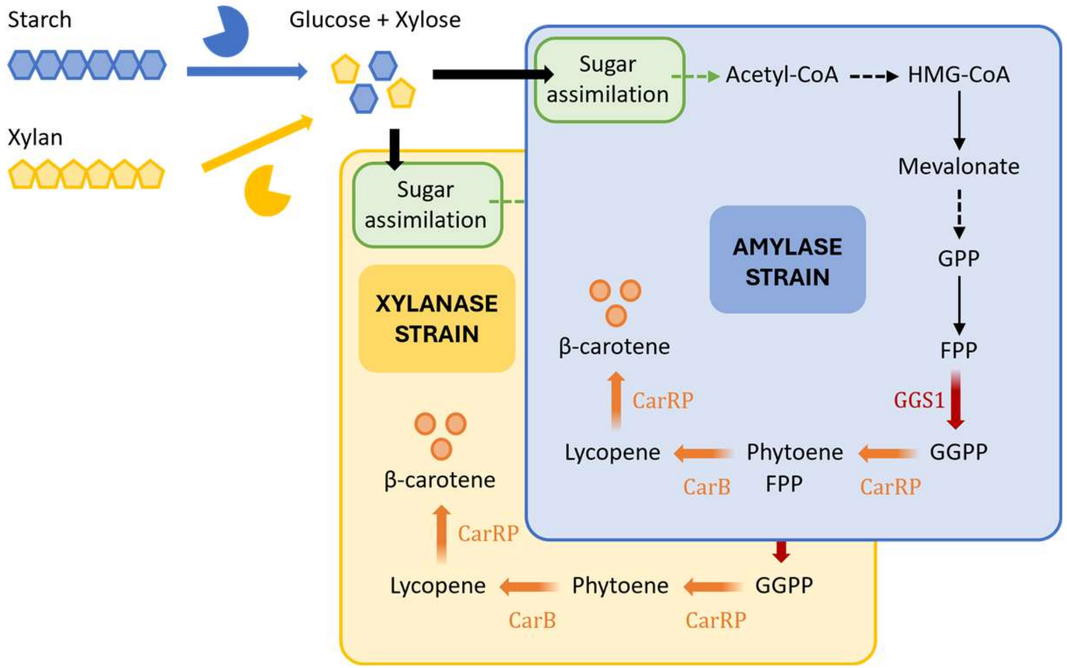


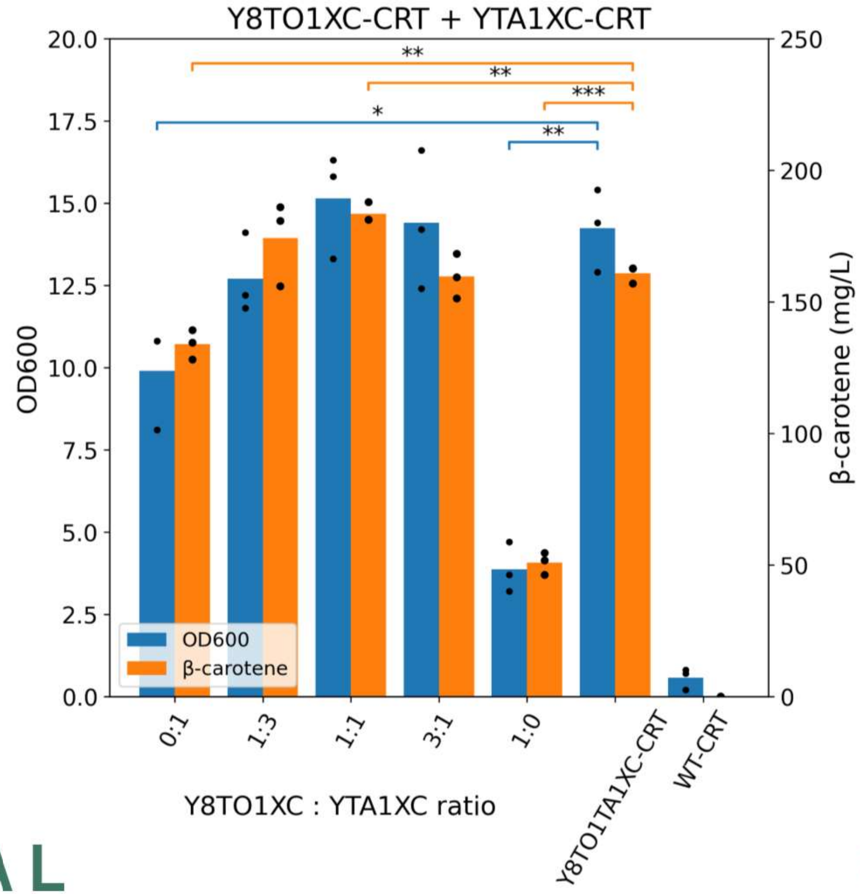



Monoculture | Generalist consumer | Orthogonal specialist | **Cross-feeding specialist**

# Applying the generalist consumer consortium to bioproduction



# The future of DOL for waste valorisation

RL LAB

**Hydrolysis functions**

**Substrate consumption**

**Functional redundancy**

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# Thank you!

**Prof. Rodrigo Ledesma-Amaro**
**Prof. Guy-Bart Stan**

**Dr Young-Kyoung Park**
**Dr Piotr Hapeta**
**Dr Cinzia Klemm**
**Dr Razieh Rafieenia**
**Dr Jing Fu**
**Dr Sebastián Tapia Leiva**

**All the other members of RLA lab, GBS lab and the Centre for Synthetic Biology**

**EPSRC BioDesign Engineering CDT**

BEZOS CENTRE FOR SUSTAINABLE PROTEIN
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MICROBIAL FOOD HUB
UKRI
Engineering and Physical Sciences Research Council
RLA LAB

THE UNIVERSITY of EDINBURGH

SUSTAINABLE EXTRICKO™

**The Sadler Lab**
*Bio-based plastic upcycling*

# Biomanufacturing chemicals using maritime waste feedstocks

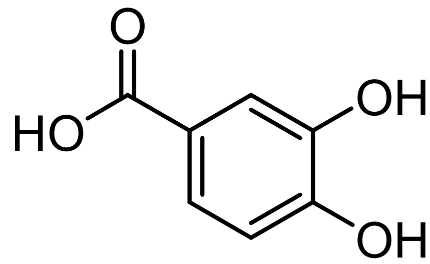
Innovate UK Project No: 10108086

**Dr Joe Penhaul Smith and Dr Joanna Sadler**

UKRI Innovate UK

# Reliance upon petrochemicals limits decarbonisation

- Protocatechuic acid is a valuable ($25 per kg) antioxidant and building block compound.
- Large market: $657.8 million (3.5% CAGR)[1]
- Carbon footprint is likely to be high, due to synthesis from petrochemical derived vanillin, 90% of which is produced from guaiacol (4.25 tonnes of $CO_{2\text{-}e}$ $kg^{-1}$ of vanillin[2]).
- Biological synthesis has been shown to be achievable[3].
- Focus upon bio-based feedstocks misses another source of above ground carbon




**Protocatechuic acid**

[1] Industry Arc., 2025. 3,4-Dihydroxybenzoic Acid Market – Forecast (2025 - 2031)
[2] (Zhao et al. 2021)
[3] (Sadler and Wallace., 2021)

# A waste opportunity

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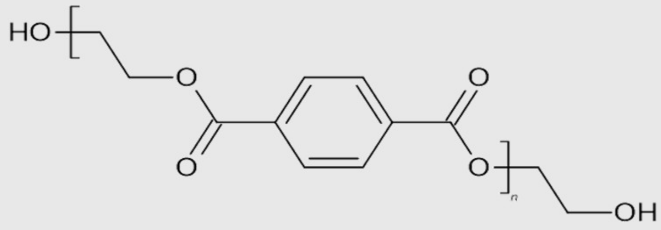
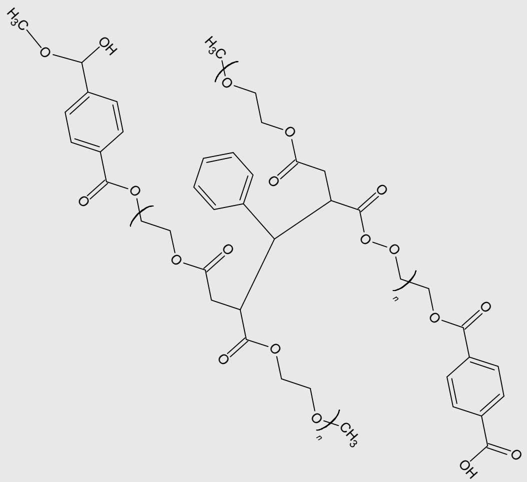
- A potentially major source use of terephthalic acid is in composites and technical textiles.
- These cost businesses to landfill (£2000 tonne$^{-1}$), but landfill bans are coming.
- These are a source of microfibres, heavy metals and microplastics.
- The TPA can be recovered using pressolysis[4]



**PET**



**Polyester resin for composites**

[4] (Warsahartana et al., 2023)

# Combining technologies

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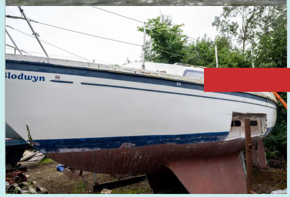
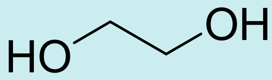
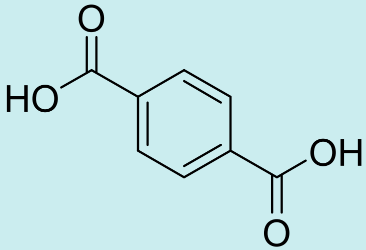
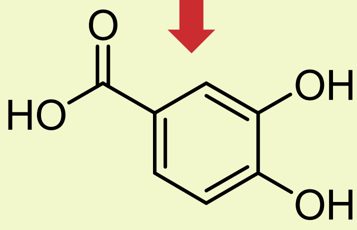





Ethylene glycol




Terephthalic acid

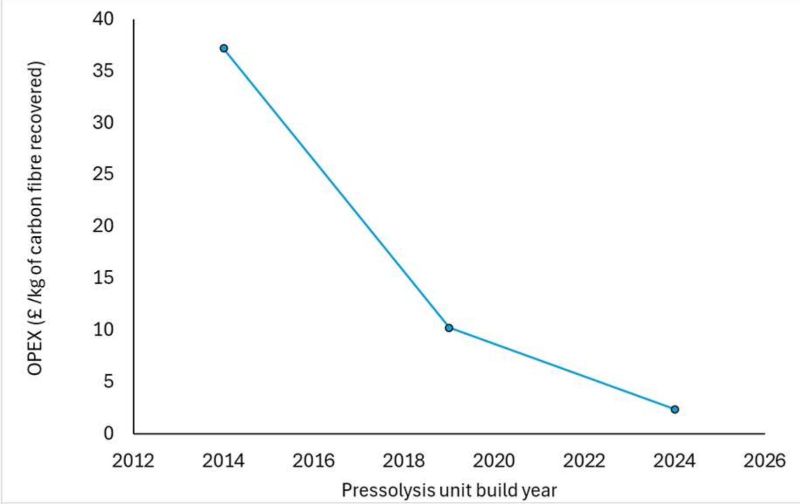


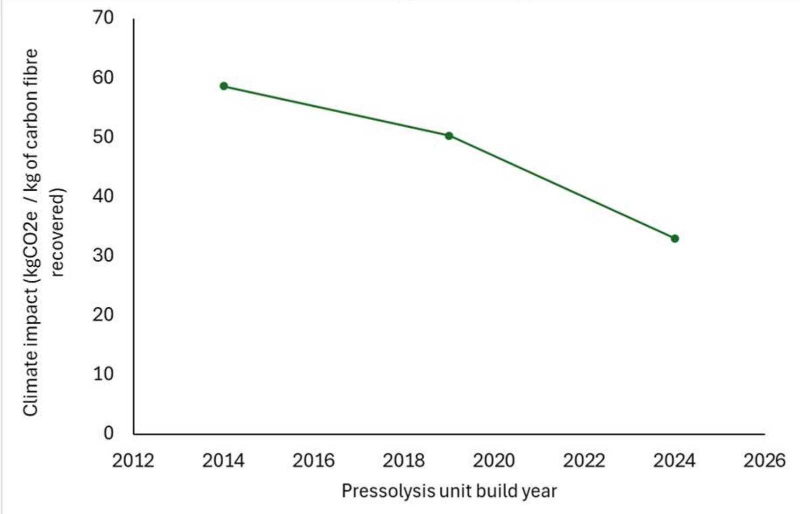

Protocatechuic acid

- Using the challenges of one industry, to meet the needs of another.
- High value products, with a lower carbon footprint than competitors.

# Why use lab systems as a baseline?

- Technologies become much more efficient as new versions are built
- These relationships are potentially predictable[5]
- Unfortunately, scaling coefficients, production cost reductions and carbon footprint reductions are not commonly reported in the literature.
- Even though these factors control if/ how a technology leaves the lab and reaches commercial scale




[5] (Nagy et al., 2013)

# Life cycle assessments in practise

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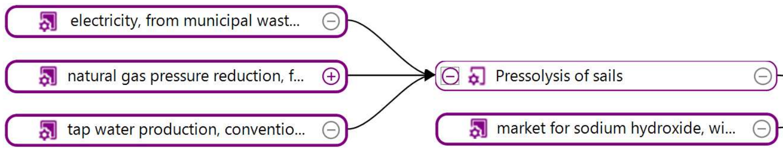
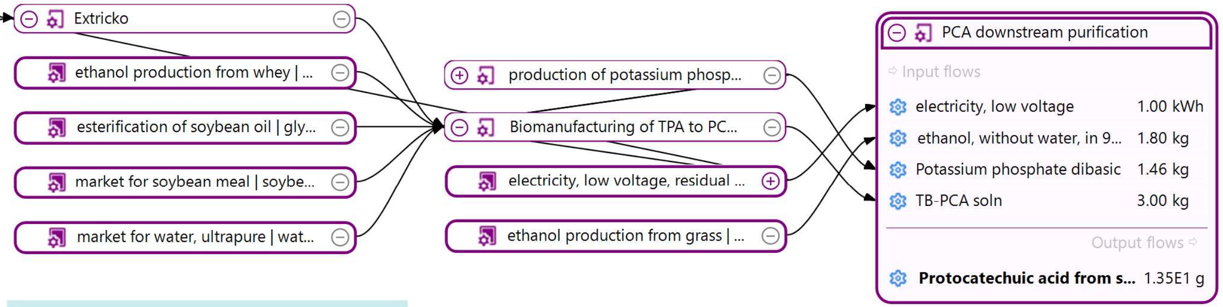



Sails are depolymerised to TPA in a pressolytic system




TPA is recovered

PCA is bio-manufactured

PCA is recovered from the culture media

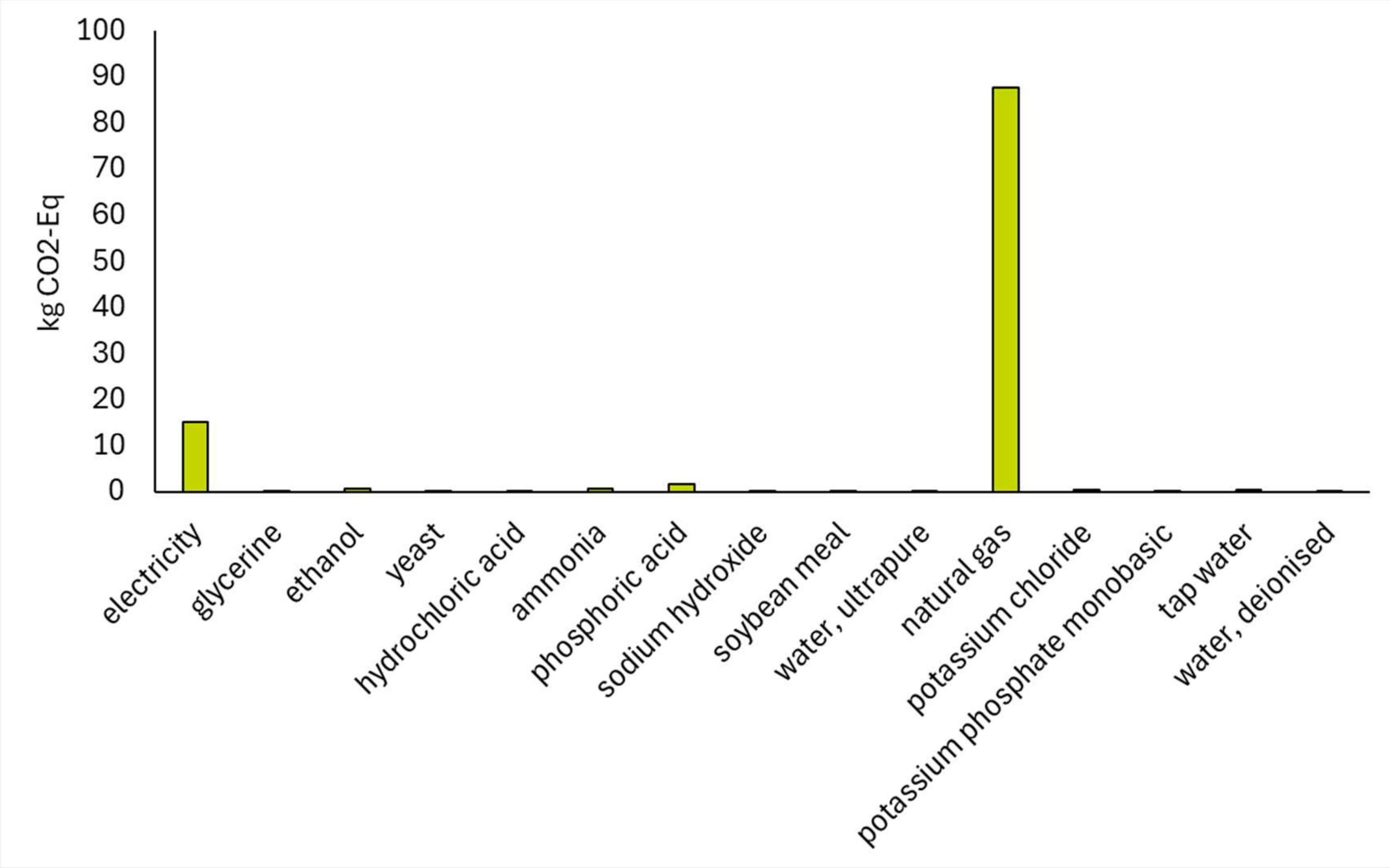
- In this first study, 35kgs of sails were depolymerised.
- A fraction of the recovered TPA was used as feedstock to produce PCA in 0.5 litre cultures

# Climate impacts are high at small scale

- 107.31 kg $CO_{2\text{-}e}$ for the production of 13g of PCA

- Energy use is a major climate impact driver, due to pressolysis being a batch process, which relies upon a gas boiler.

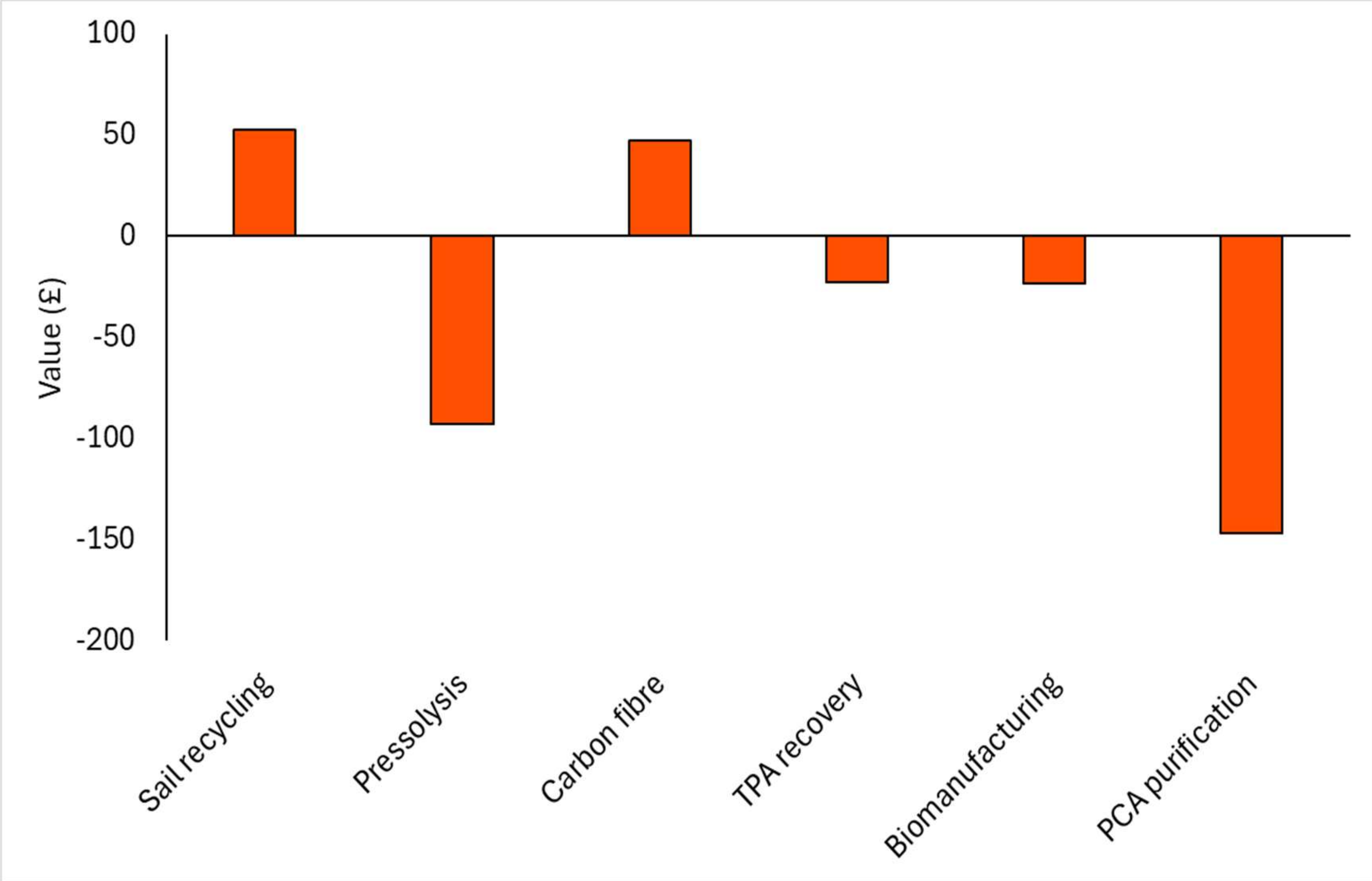
- This baseline can now be used for process decarbonisation.



# Small scale, high production costs

SUSTAINABLE EXTRICKO™

- Production cost: £285 to produce 13g of PCA (excluding staff time).
- Products can be sold for an estimated: £99
- Pressolysis and DSP were the main OPEX sinks.
- This baseline can now be used for process decarbonisation.



**The Sadler Lab**
*Bio-based plastic upcycling*

- Recycled sources of organic carbon are an underutilised resource.
- Combining chemical recycling and bioproduction can address some of the limits of these technologies.
- LCAs and TEA should be conducted early, to give an indication of focus areas for development, if commercialisation is a target.

# Thank you for listening

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Find out more by following the link

# Chitin-degrading enzymes:
# Potential tools for wide biotechnological applications


Mohammad Dadashipour,

Teesside University

4th BBNet Conference

Sheffield-16/10/2025

Teesside University

School of Health & Life Sciences

NATIONAL HORIZONS CENTRE

# New institutions for research, partnerships and training



**National Horizons Centre (NHC) in Darlington**

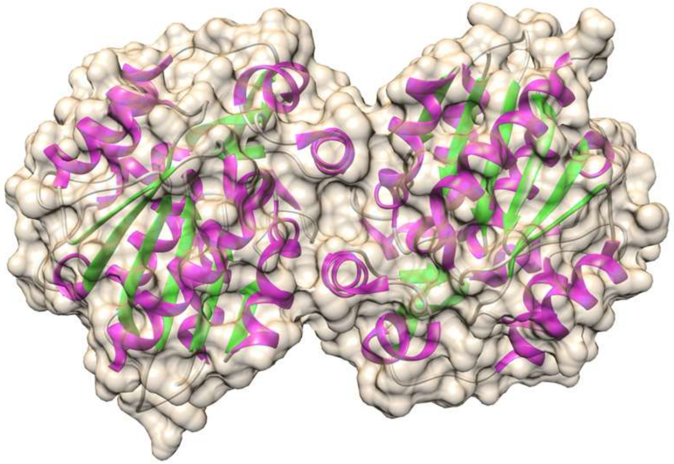
- Biodiscovery
- Biomanufacturing
- Sustainable futures
- Bioeconomy
- Digital health

**Net Zero Industry Innovation Centre (NZIIC) In Middlesbrough**

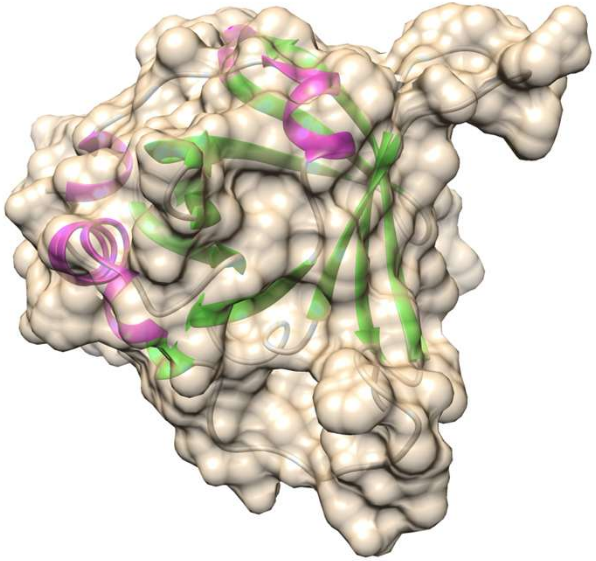
- Hydrogen
- Circular economy
- Smart energy
- Carbon, Capture, Utilisation & Storage

# My research: past and present

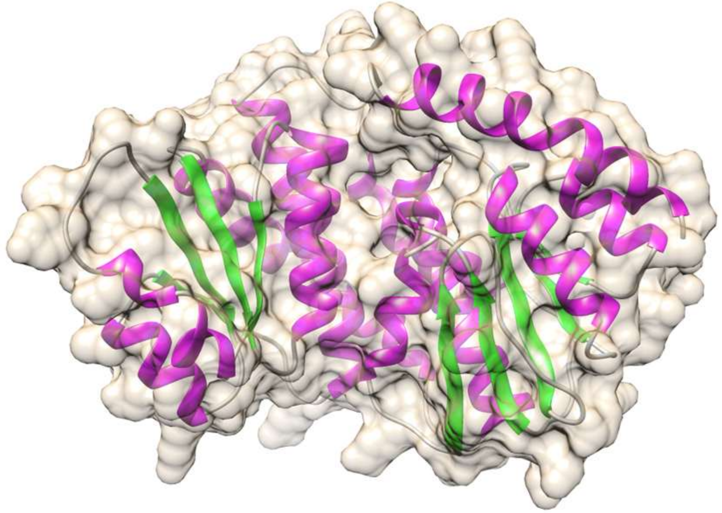
- Enzyme discovery and engineering for biocatalysis



3WWO (*S*-*Bm*HNL from a **plant**)



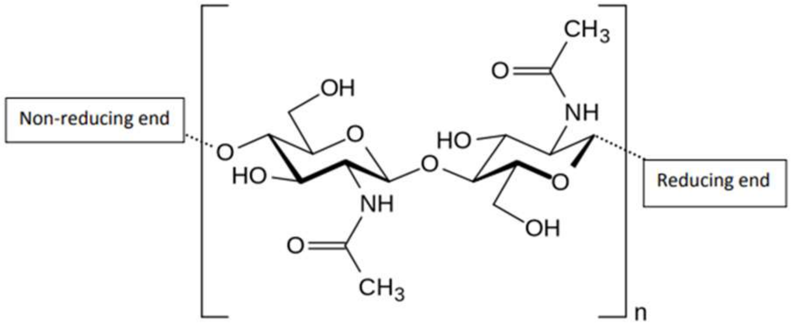
6JHC (*R*-*Ch*HNL from **millipede**)



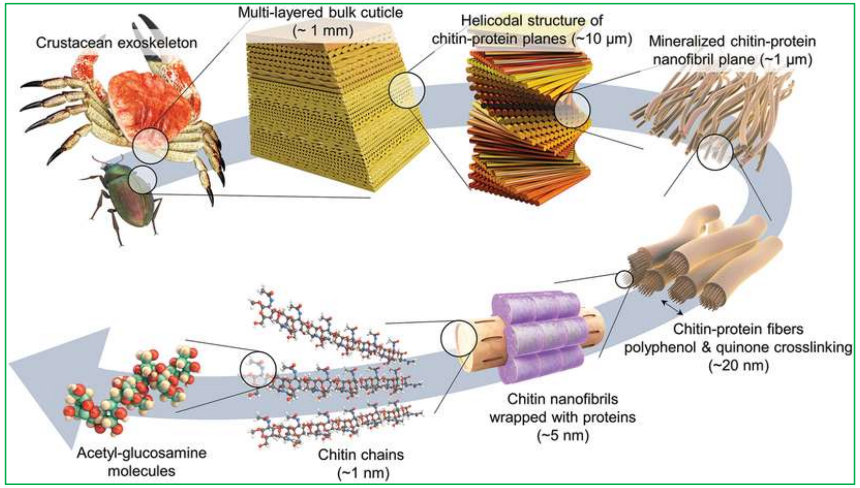
(Thermostable epimerase from an **Archaeon**)

- Enzyme engineering and pathway assembly for biomanufacturing (focuses on carbohydrate-metabolising enzymes)
- Engineering of diagnostic enzymes & proteins
- Waste valorisation for a circular economy (e.g., Chitin-degrading enzymes, including antifungal chitinases)

# Basic facts about chitin



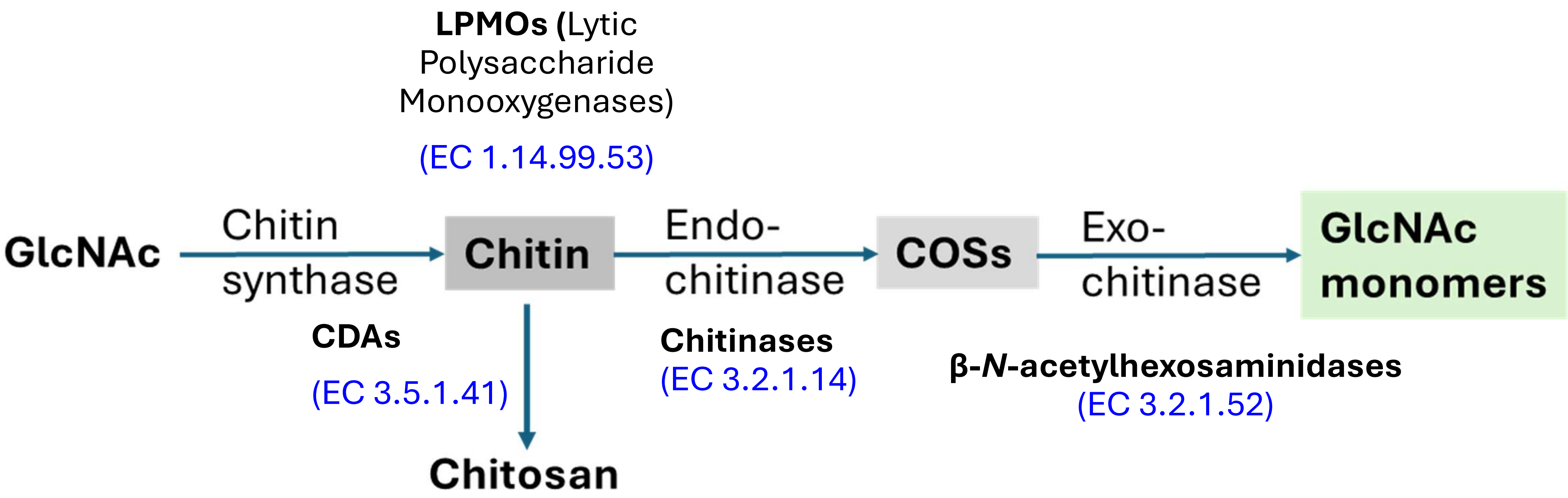

- The 2nd biopolymer after cellulose: up to $10^{11}$ (100 BT/Year), both **terrestrial** and **marine**
- Exoskeletons of crustaceans and insects, cell walls of fungi and certain algae
- No report of their accumulation in nature



# Chitin-degrading enzymes (CDEs) and their products (COSs)

- Cheap recombinant enzyme as a product
- Food industry
- Wastewater treatment
- Agriculture (biological fertilisers)
- Environmental protection (alternatives to harmful pesticides)
- Pharmaceutical and biomedicine (COSs)


# Chitin-degrading enzymes (CDEs): It is a system



# Why are chitin-degrading enzymes not widely used?

- **Limited availability** of potent producers
- **Low or moderate activity and stability**
- **Low yield** and **expensive** recombinant production
- **Costly downstream** [causes usage of crude preparations]
- **Reduced catalytic efficiency** [HCPs and complexity with product purification]
- Maintaining consistency and quality during scale-up is challenging

# Motivations for screening new chitin-degrading enzymes

- Screen less explored resources
- **Higher activities**
- **Novel extracellular chitinases** (especially those tolerating **high pH, high temperature**)
- **Wider substrate specificities**
- **Better recombinant expression and purifications** (lowering the cost)
- **original/ novel** discoveries for enzyme engineering opportunities
- Feasibility of employing an **enzyme cocktail**

# Screening for new enzyme sources

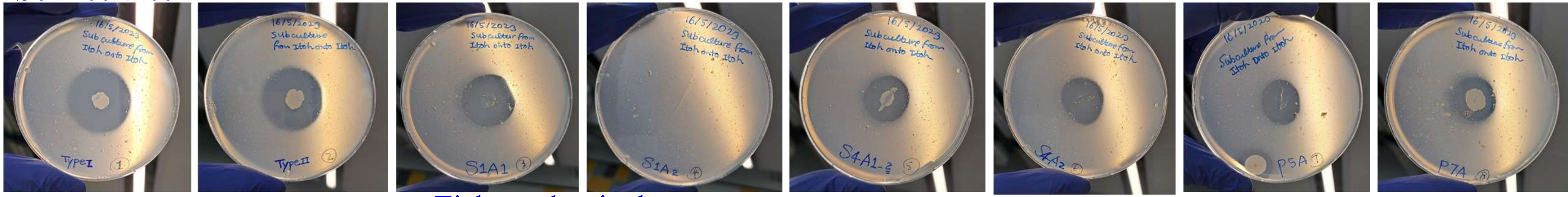
- **Conventional, an old-school method**
  - **Soil**
  - **Seawater**
  - **Fish and seafood sources**
  - Wastewater
  - Hot springs

- **Advanced technologies**
  - Bioinformatics-based screening (not a good experience with this!)

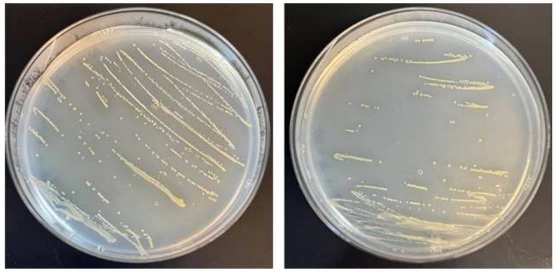
# Some screening outcomes

- Colloidal Chitin preparation
- Screening in minimal media plus the natural substrate: **eat or die!**
- Liquid cultures and plates

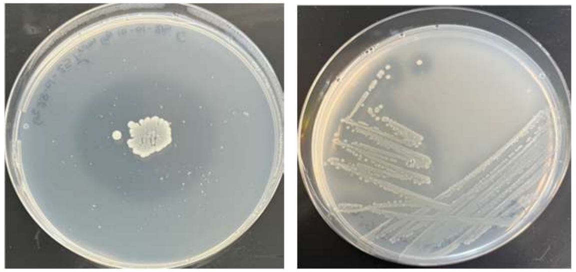
Soil isolates



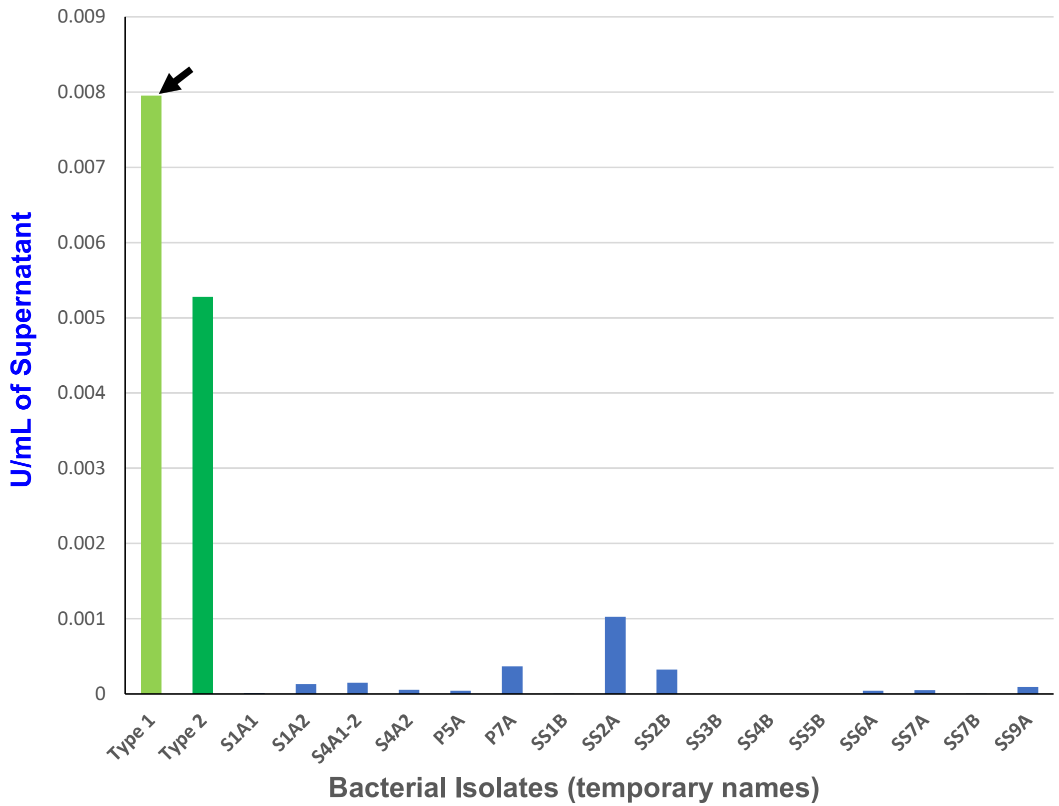
Seawater isolates

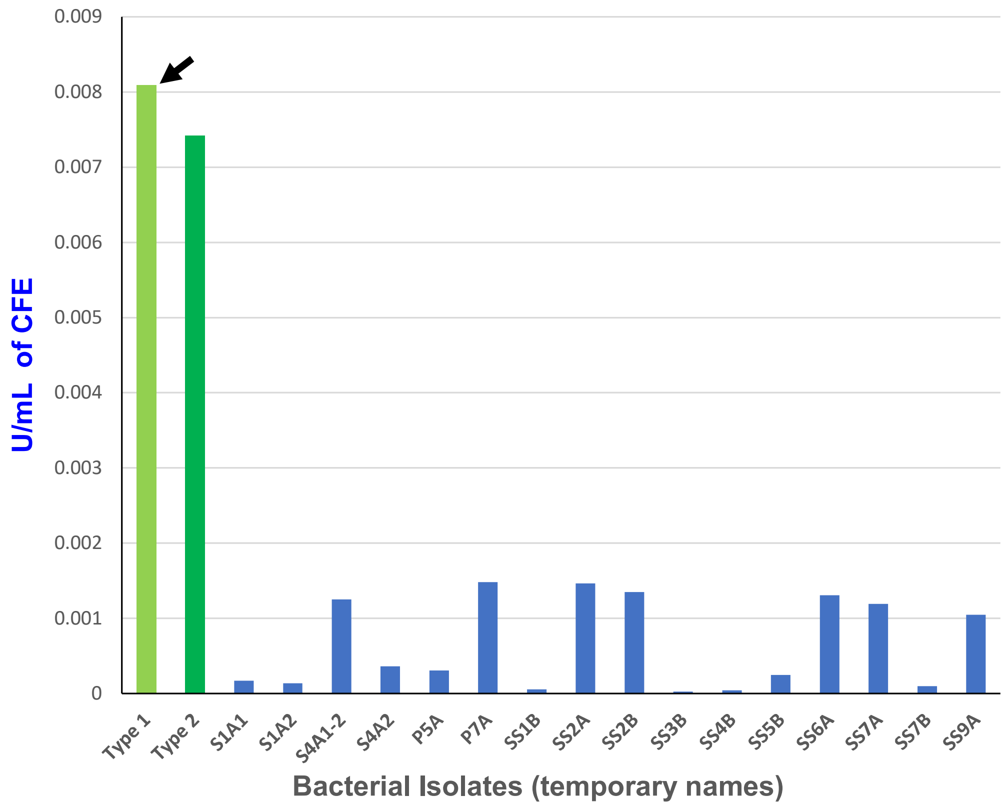


Fish market isolates



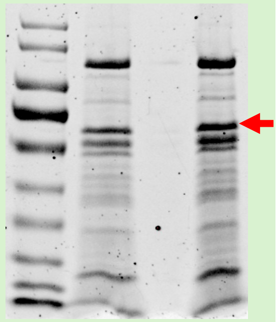
# Examples of enzymatic assays



# Chitinase from *Serratia* sp.

Active supernatant analysis using SDS-PAGE



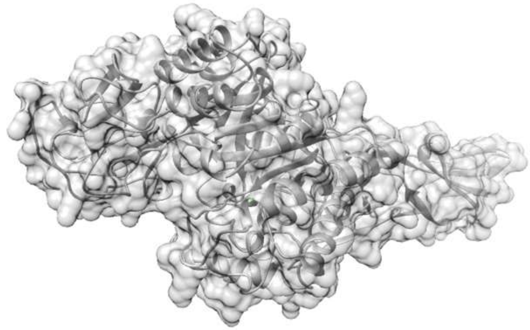
In-gel digestion & MS Spectrometry analysis

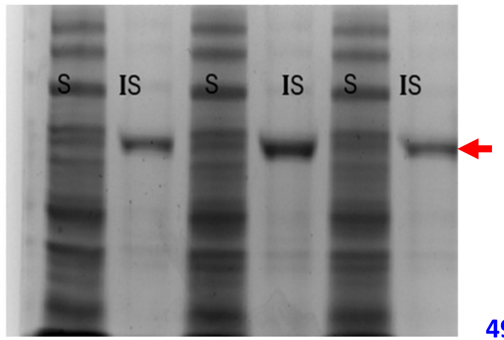
16S rRNA of the bacterium

Whole ChiA sequence of the chitinase enzyme

Gene synthesis and recombinant expression in *E. coli*

GH18 chitinase





# Ongoing & further research

- **Identifying rest of existing isolates and their enzymes** including β-*N*-acetylhexosaminidases & LPMOs

- **Studying the mixed cultures** and the degradation system as a whole

- **Expanding sampling** to hot springs & wastewaters

- **Engineering** selected CDEs

# Acknowledgements


## Microbial screenings and enzyme assays

- **Sumitha** Manoj
- **Stacey** Speight
- **Heavenard** Aning-Sarpong
- **Prince** Antwi
- **Agdafna** Sidina Dah
- **Ibrahim** Oppong
- **Kalani** Galagamage

## Mass spectrometry analysis

- **Dr Claire** Jennings

## ÄKTA purification

- **Guru**raja Mandagaddi
- NHC technicians

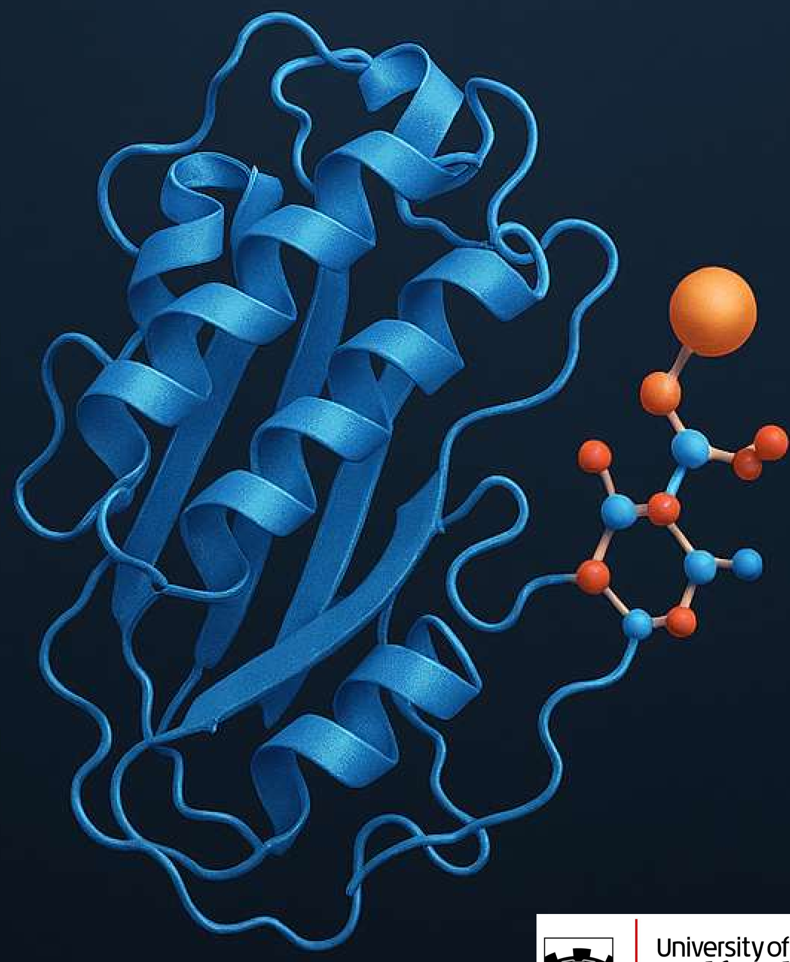
## And

- NHC technicians

# Characterisation of Novel Biocatalysts with Unique Properties

Towards a sustainable and efficient biocatalysis

Henry Madubuike, PhD, CSci, MRSB, FHEA
University of Salford, Manchester.



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# Biocatalysis

- Biocatalysis refers to the use of enzymes to speed up (catalyse) chemical reactions.
- Biocatalysts are rapidly replacing inorganic catalysts, offering enormous benefits in industrial applications due to their distinct properties.
- Biocatalysts promote clean reactions with low environmental damage, reactions with less toxic by-products, and the possibility of synthesising novel products that were not feasible using inorganic catalysts.
- Despite the various advantages and undeniable potentials of enzyme-linked biocatalysis, the performance of enzymes in industrial conditions is still a major drawback to their applications.

# Biocatalysts

- Selective reactions

- Fulfilling reactions with unparalleled chemo-, chiral (stereo/enatio-) and positional (regio-) selectivities.

- Improving process safety and contributing towards sustainability.

- Driven by advances in genomics, analytical and computational tools, resulting in the discovery and evolution of enzymes for biotechnological applications.

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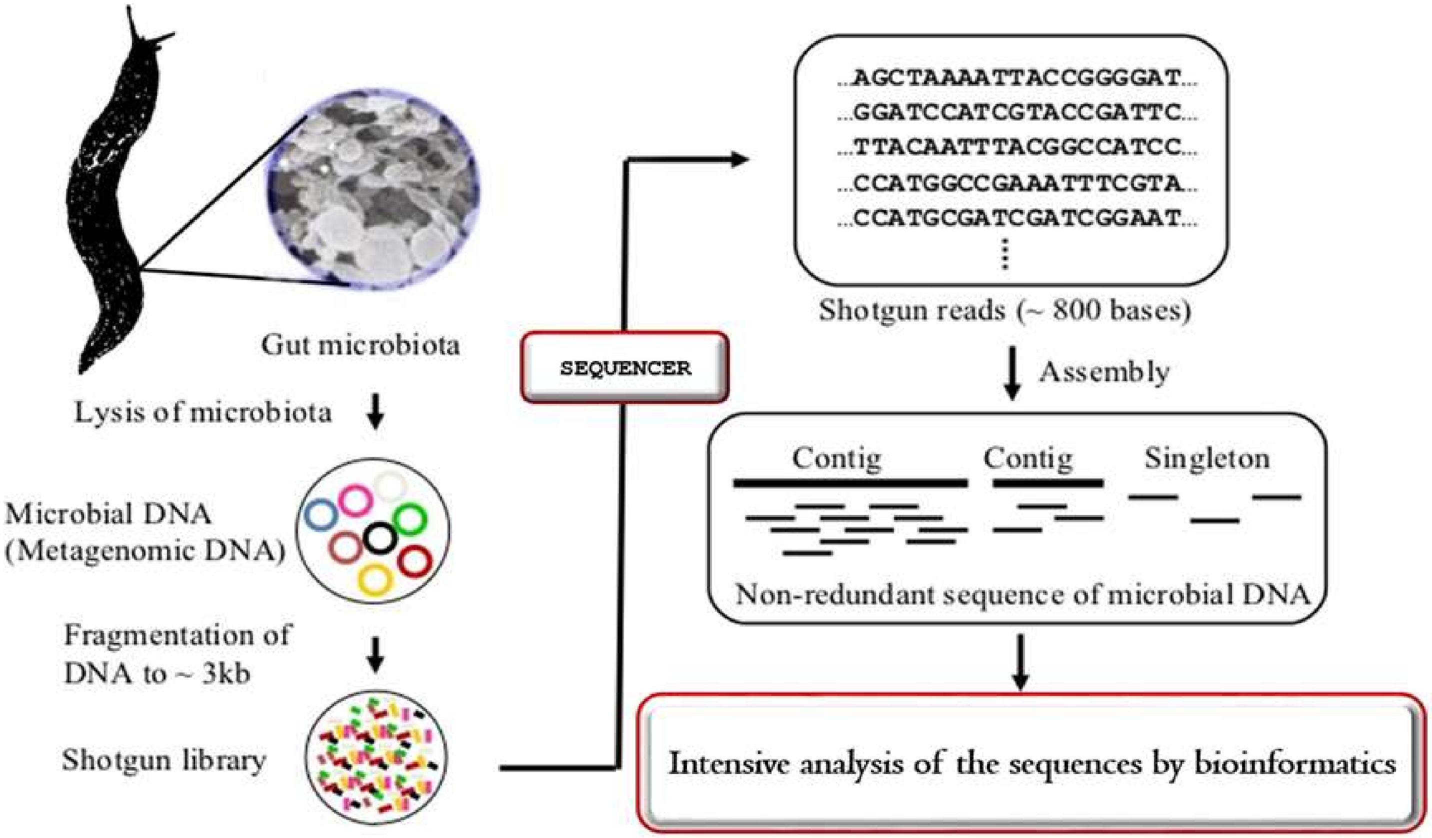
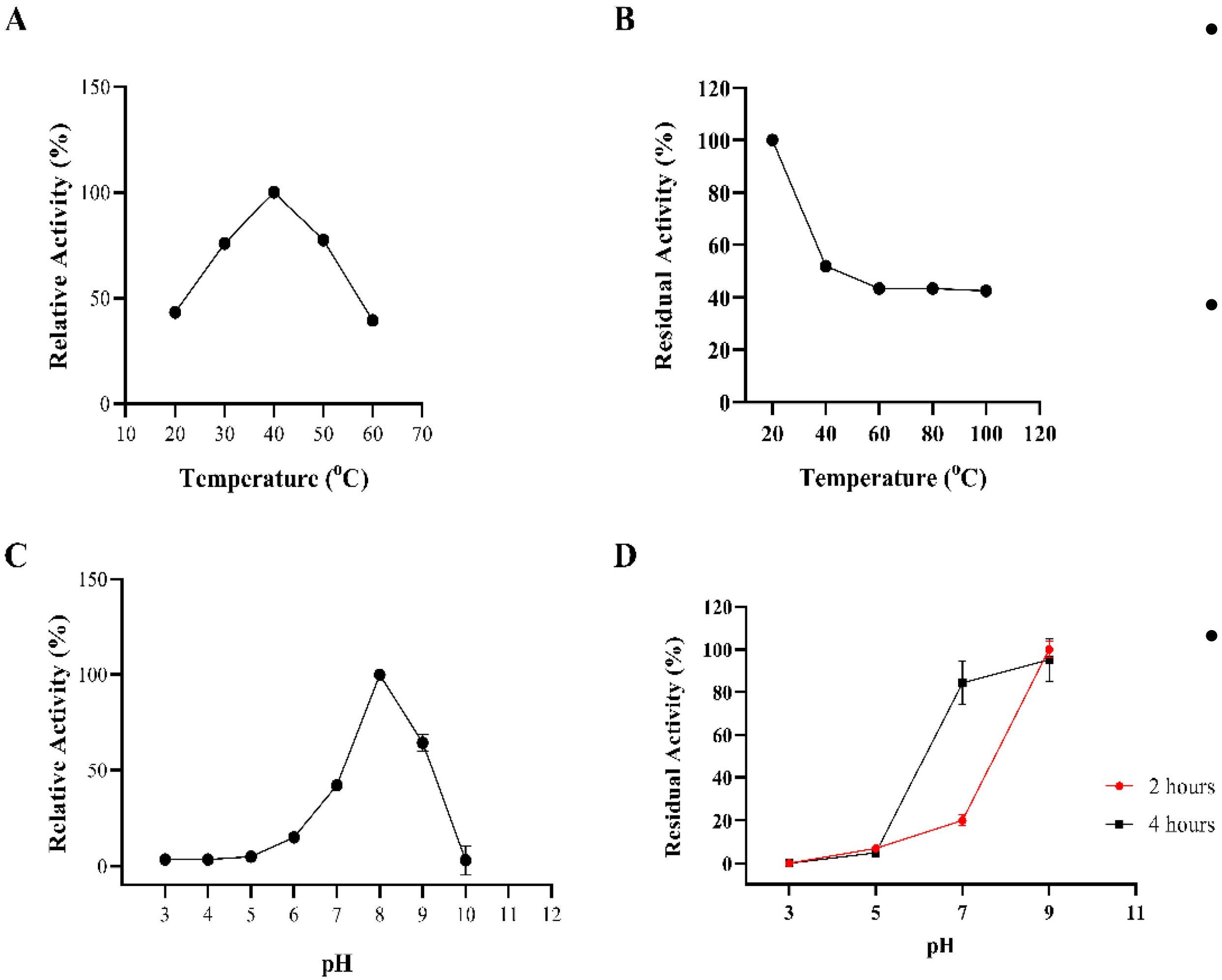
# Bioprospecting Novel Biocatalysts




Joynson et al., 2017

Madubuike, H.; Ferry, N. Characterisation of a Novel Acetyl Xylan Esterase (BaAXE) Screened from the Gut Microbiota of the Common Black Slug (Arion ater). Molecules 2022, 27, 2999. https://doi.org/10.3390/molecules27092999

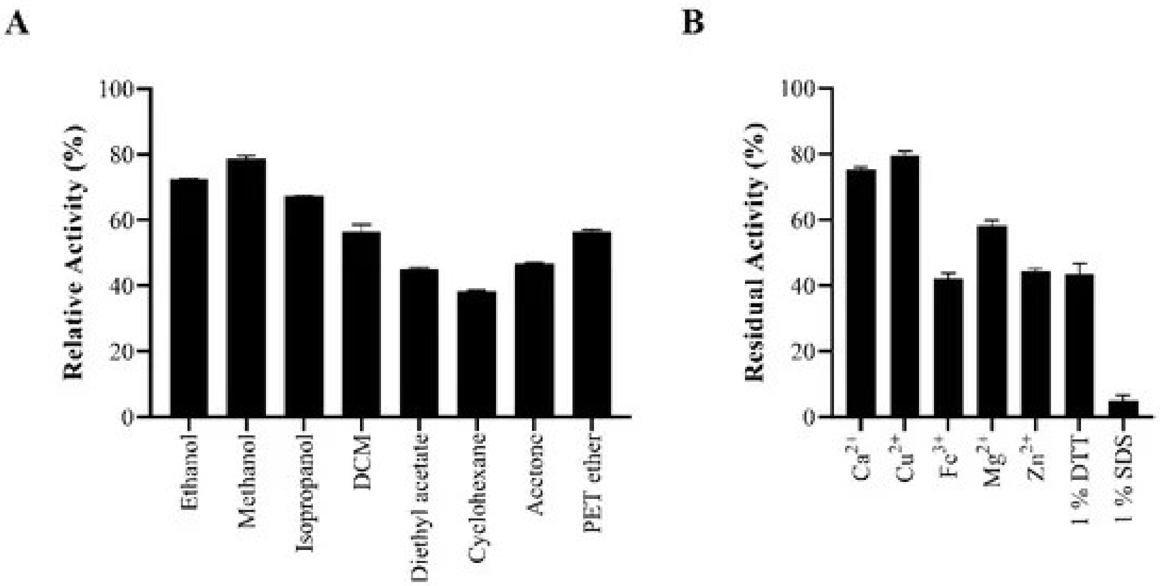
# Biochemical Characterisation




- The biochemical properties of BaAXE were investigated in assays with 4-Nitrophenyl Acetate as the substrate. BaAXE showed optimal activity at pH 8 and 40 °C (A and B).
- A thermostability assay showed that the BaAXE retained around 40% activity after incubating the enzyme for 2 h at 40–100 °C but showed no clear activity at acidic pHs (C).
- At pH 7 and 9, BaAXE retained over 80% activity after incubating the enzyme for 4 h (D)

Madubuike and Ferry, 2022

# Biochemical Characterisation



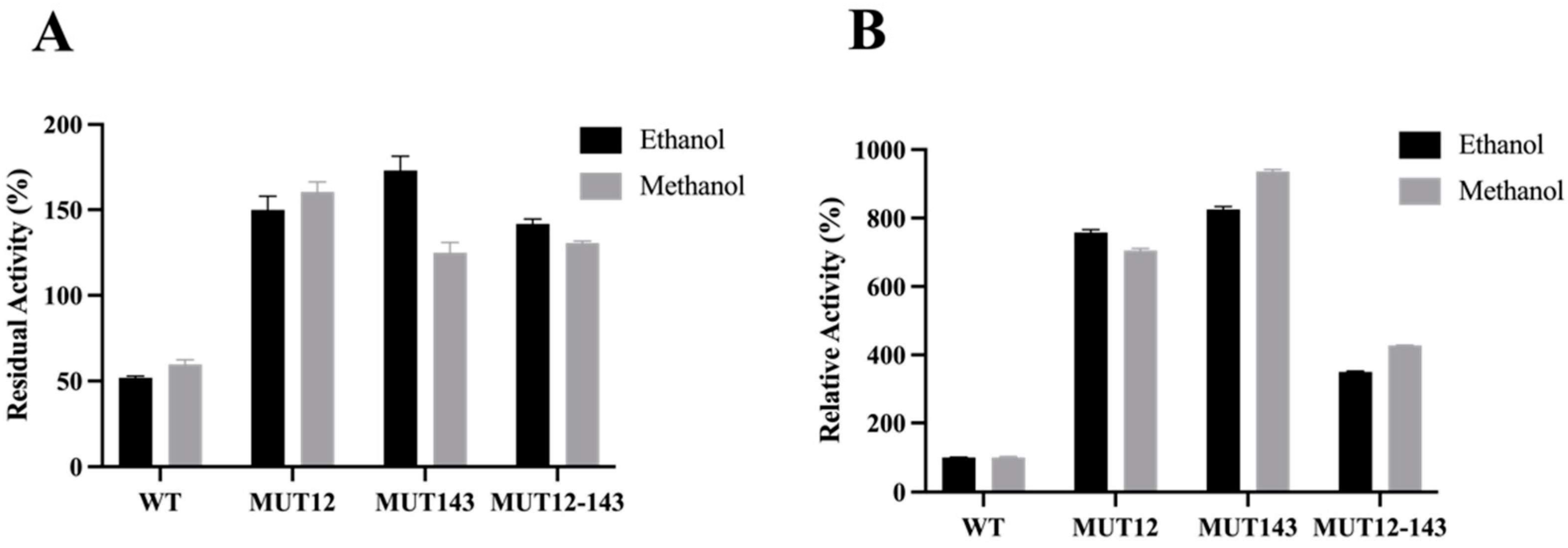

- BaAXE was moderately impacted by organic solvents at 20% (v/v), retaining over 60% activity in most of the solvents tested after a 17 h incubation (A).

- Enzyme activity was moderately impacted by metal ions, as the enzyme retained over 40% activity after incubation in a 1 mM concentration of the metal salt. The activity of the enzyme was severely impacted when incubated with 1% SDS, retaining only 5% activity after incubation (B)

Madubuike and Ferry, 2022

Madubuike, H.; Ferry, N. Enhanced Activity and Stability of an Acetyl Xylan Esterase in Hydrophilic Alcohols through Site-Directed Mutagenesis. Molecules 2023, 28, 7393. https://doi.org/10.3390/molecules28217393

# Stability in hydrophilic organic solvents



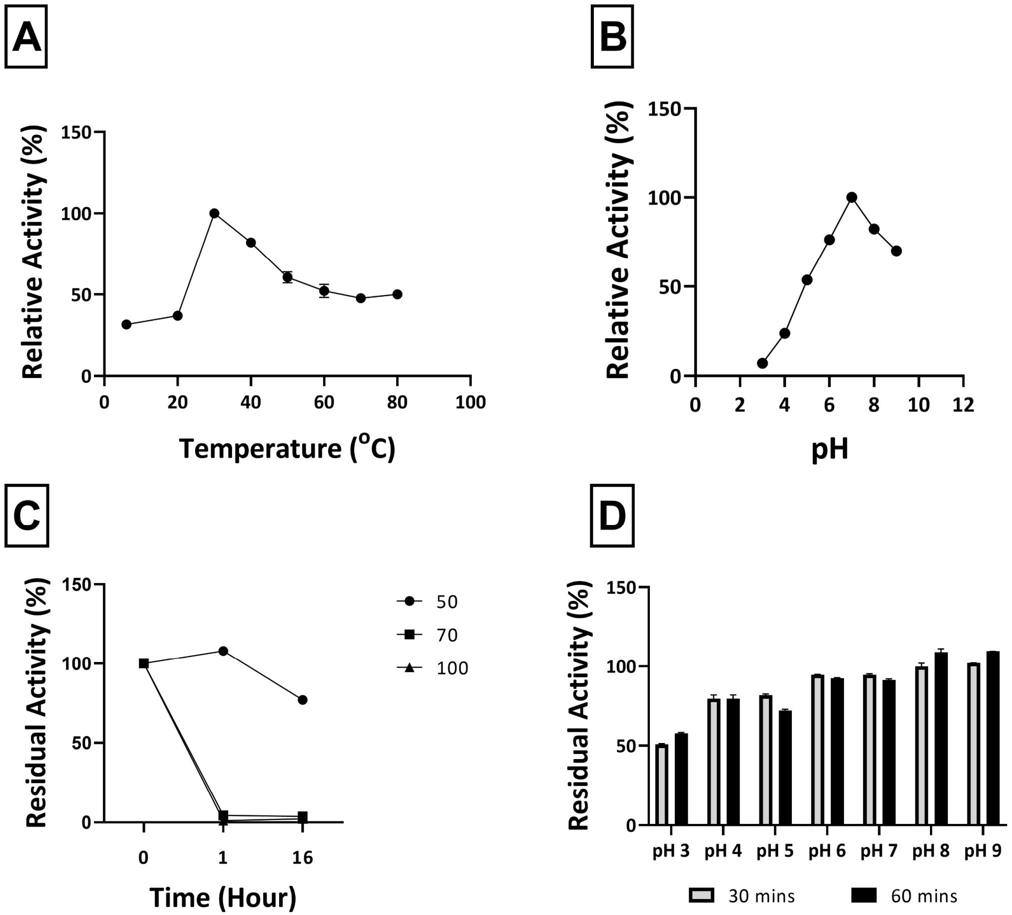

MUT12 and MUT143 showed over 700% higher activity, and >120% stability in the presence of 20% hydrophilic organic solvent compared to the wild type

Madubuike and Ferry, 2023

Family 43 glycosylhydrolase

[*Kluyvera cryocrescens*]

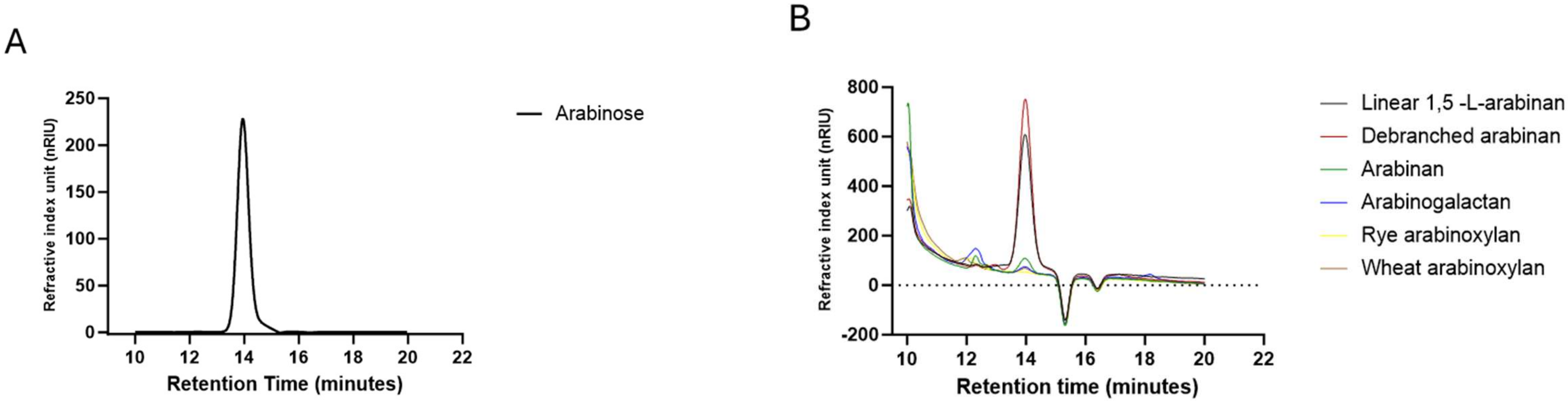
# Biochemical characterisation




The biochemical properties of KcArf were determined in an assay with 4-Nitrophenyl-α-L-arabinofuranoside.

A) The optimal temperature was assayed at different temperature and activity was calculated relative to the optimal temperature.
B) The optimal pH was assayed at different pH values and activity was calculated relative to the optimal temperature.
C) The temperature stability was assayed at different temperature and stability calculated relative to the control assay with no temperature incubation.
D) The pH stability was assayed at different pH values and stability was calculated relative to a control assay at time 0.

# Activity on Natural Substrates




The functional activity of KcArf was further analysed on natural substrates for the release of arabinose. A) Arabinose standard was run on the column as a locator B) 0.25% of the substrate was reacted with ~4ug of KcArf and the release of arabinose was analysed using a refractive index detector.

# Effect of Additives

| Additive | Relative activity (%) ± SEM |
|---|---|
| 20% Ethanol | 95.32 ± 0.41 |
| 20% Methanol | 66.55 ± 0.71 |
| 1 mM Calcium chloride | 759.86 ± 3.3 |
| 1 mM Magnesium chloride | 155.18 ± 0.2 |
| 1 mM Potassium chloride | 99.66 ± 0.49 |

- The activity of KcArf was not inhibited by any of the additives but activity was improved in the presence of calcium and magnesium ions.
- Divalent metal ions such as $Zn^{2+}$, $Mn^{2+}$, $Cu^{2+}$, $Mg^{2+}$, and $Ni^{2+}$ has been generally reported to improving catalysis compared to normal conditions which is consistent to the result in this study [21].

# Key Finding and Impact

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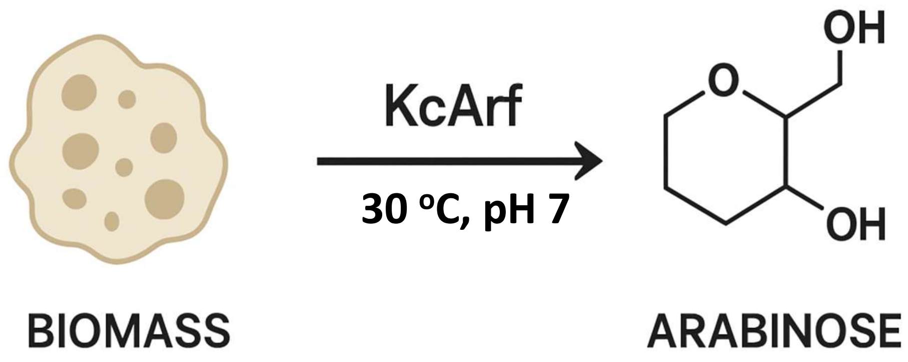



- The biochemical and functional properties reported here present KcArf as a high biotechnological potential.
- Current classification of biocatalysts does not adequately capture their unique properties, which are essential for informing the design of enzyme cocktails for sustainable biotechnological applications.
- This study contributes useful data that supports the design of sustainable bioprocesses, such as in the production of arabinose.

# Thank you

From all of us at the Madubuike and Ferry Lab

# Developing frameworks that deliver whole-system sustainability benefits for the bioeconomy

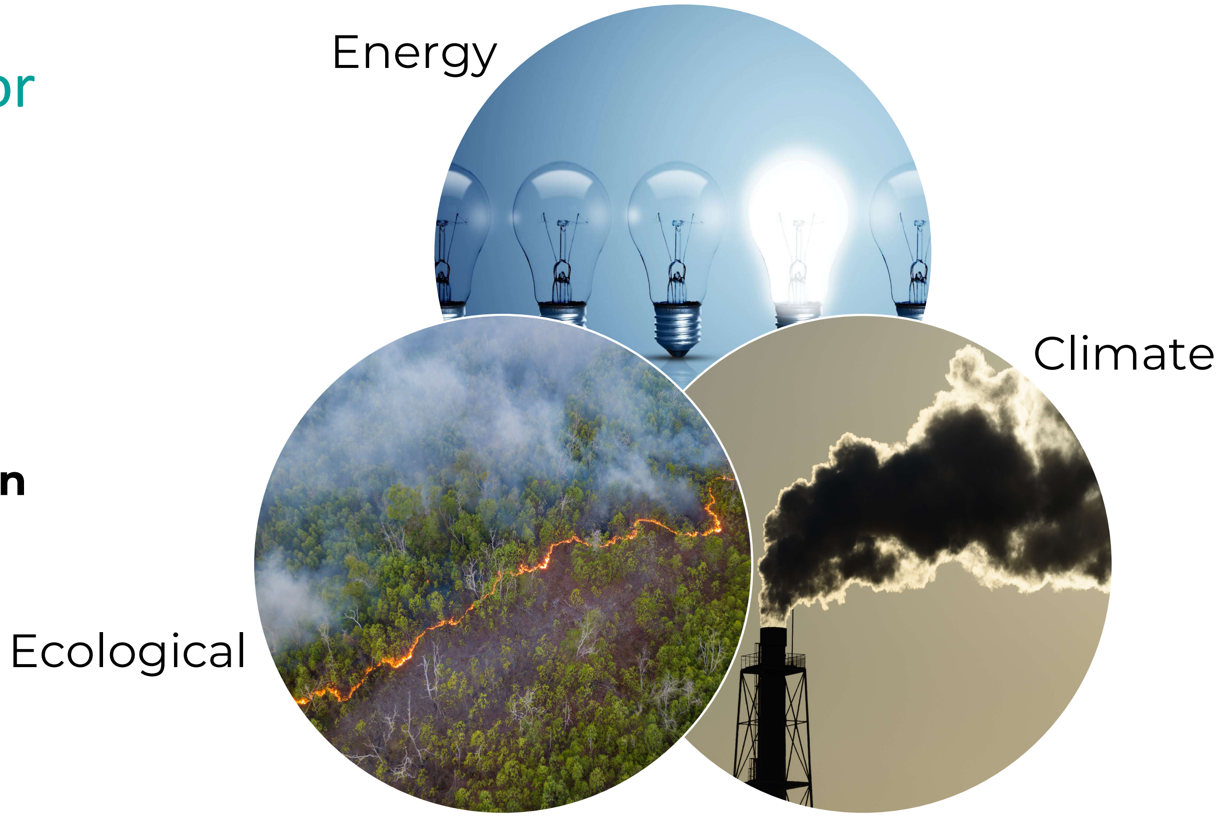
**Daniel Taylor & Mirjam Röder**
Energy & Bioproducts Research Institute
Aston University, UK

4th BBNet Conference

# A small but significant role for biomass

Overlapping crises happening at once require a series of solutions working together.

**Biomass can be part of the solution to all these crises, achieved through change in our political, economic, and societal systems.**




**Taylor, D., Chong, K., & Röder, M. (2024).** Designing biomass policy: The political economy of renewable energy for net zero. WIREs Energy and Environment, 13(2), e512.

# UK Government Areas of Research Interest (ARIs)

“Enabling technologies and fuels that underpin delivery of decarbonisation across many sectors, **as enablers for transition to, and delivery of, a decarbonised economy, including biomass**”

**“Whole system approach essential** to delivery of net zero, which is a systems challenge”

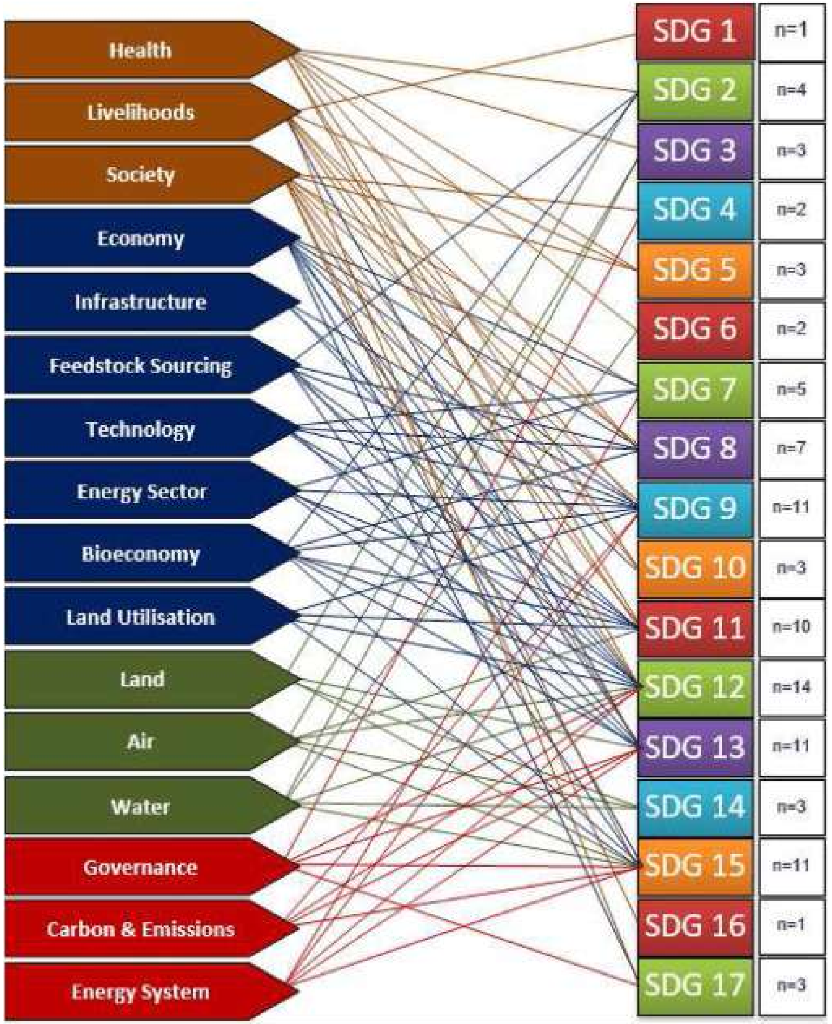
Increasing understanding of **non-energy uses of biomass**, such as in chemicals and steel, and identifying opportunities, tensions, and impacted biomass types.

Exploring **biomass sustainability issues**, including forest carbon, soil carbon, indirect land use change, cascading use, and monitoring, reporting and verification in supply chains.

# Bioeconomy Sustainability Indicator Model (BSIM)

Enabling the user to account **for sustainability risks and benefits against weighted indicators** framed around the Sustainable Development Goals (SDGs).

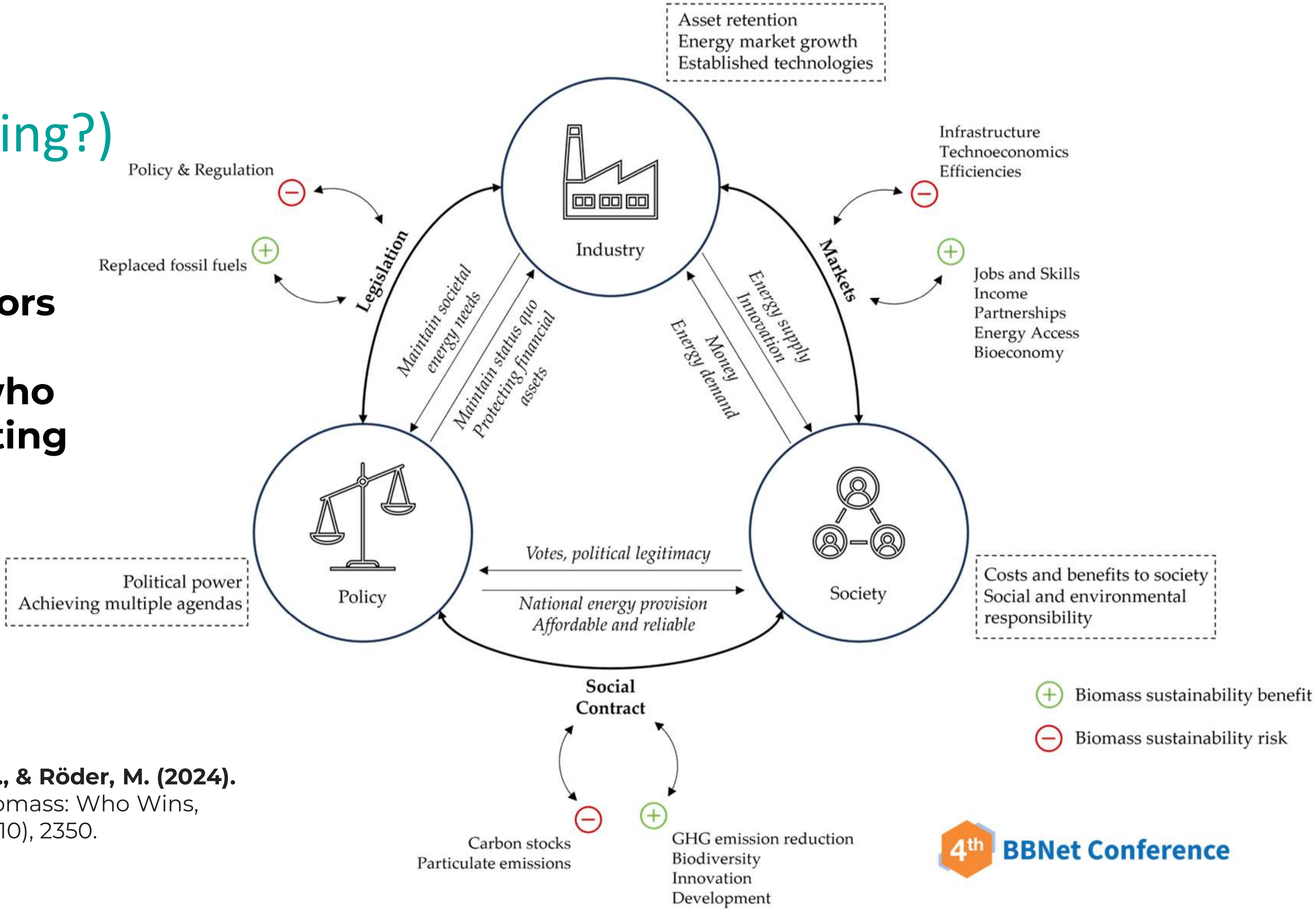
Develop an understanding of the risks and benefits **across the life-cycle of a project**.




**Welfle, A., & Röder, M. (2022).**
Mapping the sustainability of bioenergy to maximise benefits, mitigate risks and drive progress toward the Sustainable Development Goals.
*Renewable Energy, Volume 191.*

# The enabling (or disabling?) environment for policy

**Political and economic factors impacting biomass and the bioeconomy**, determining **who benefits from biomass**, **setting the rules** of policy and sustainability goals.




**Taylor, D., Sparks, J., Chong, K., & Röder, M. (2024).** Determining the Benefits of Biomass: Who Wins, and Who Loses? *Agronomy*, *14*(10), 2350.

# Areas that need more understanding

## Impact of competing priorities at difference governance levels

- National objectives at the cost of regional/local sustainability?
- Regional differences in sustainability?

## Synergies between indicators and inherent trade-offs

- Which indicators are linked?
- Which indicators are greater determinants of whole system sustainability?

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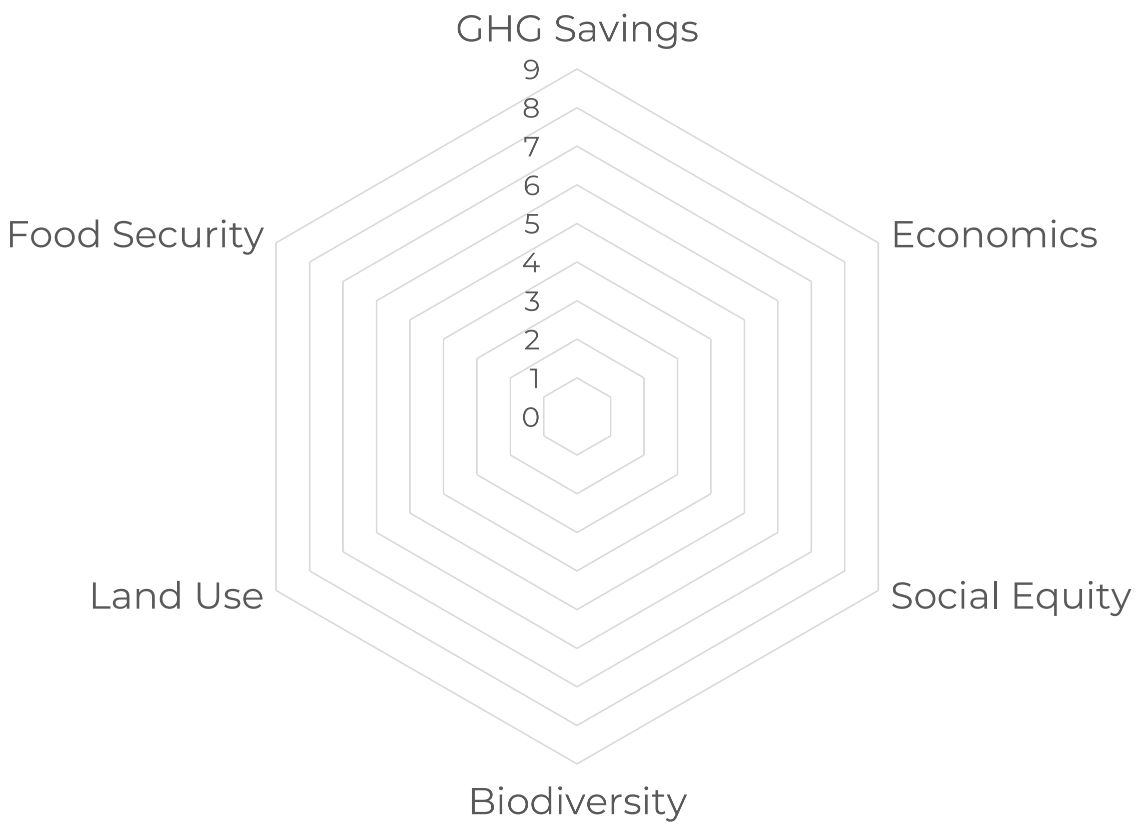
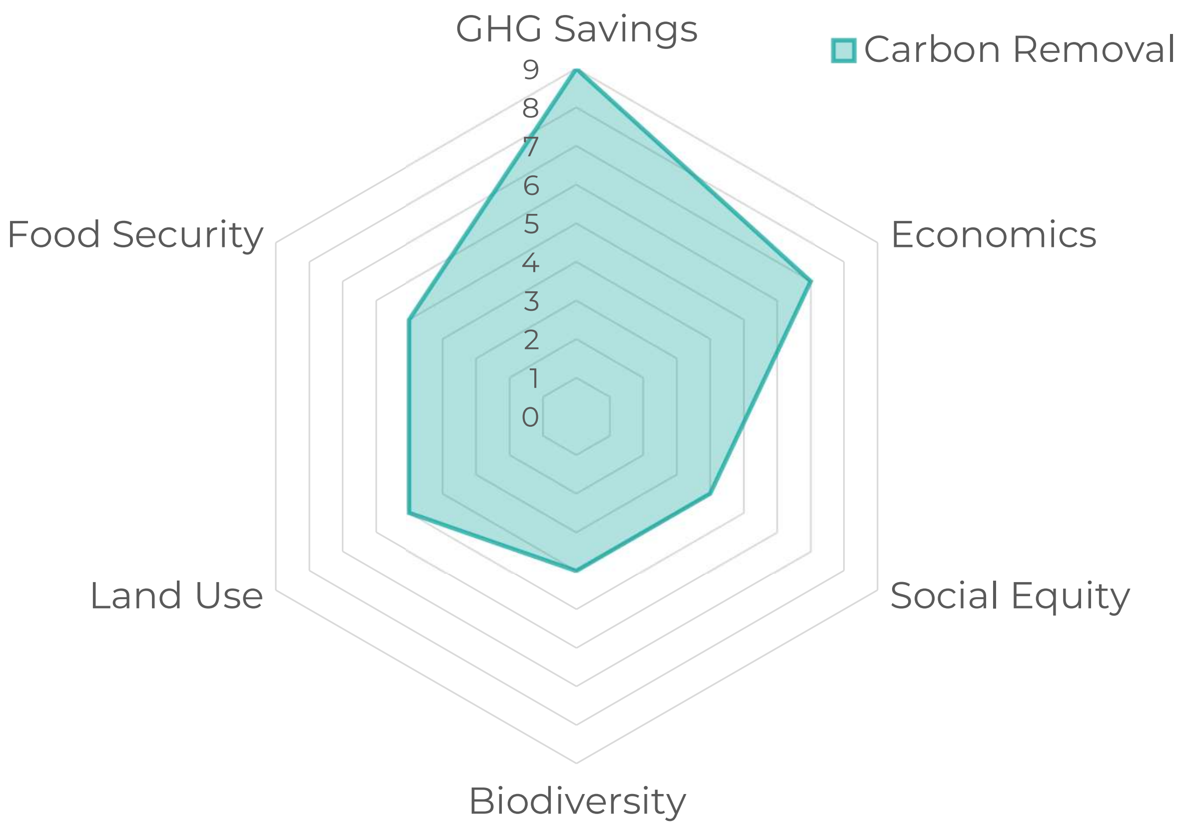
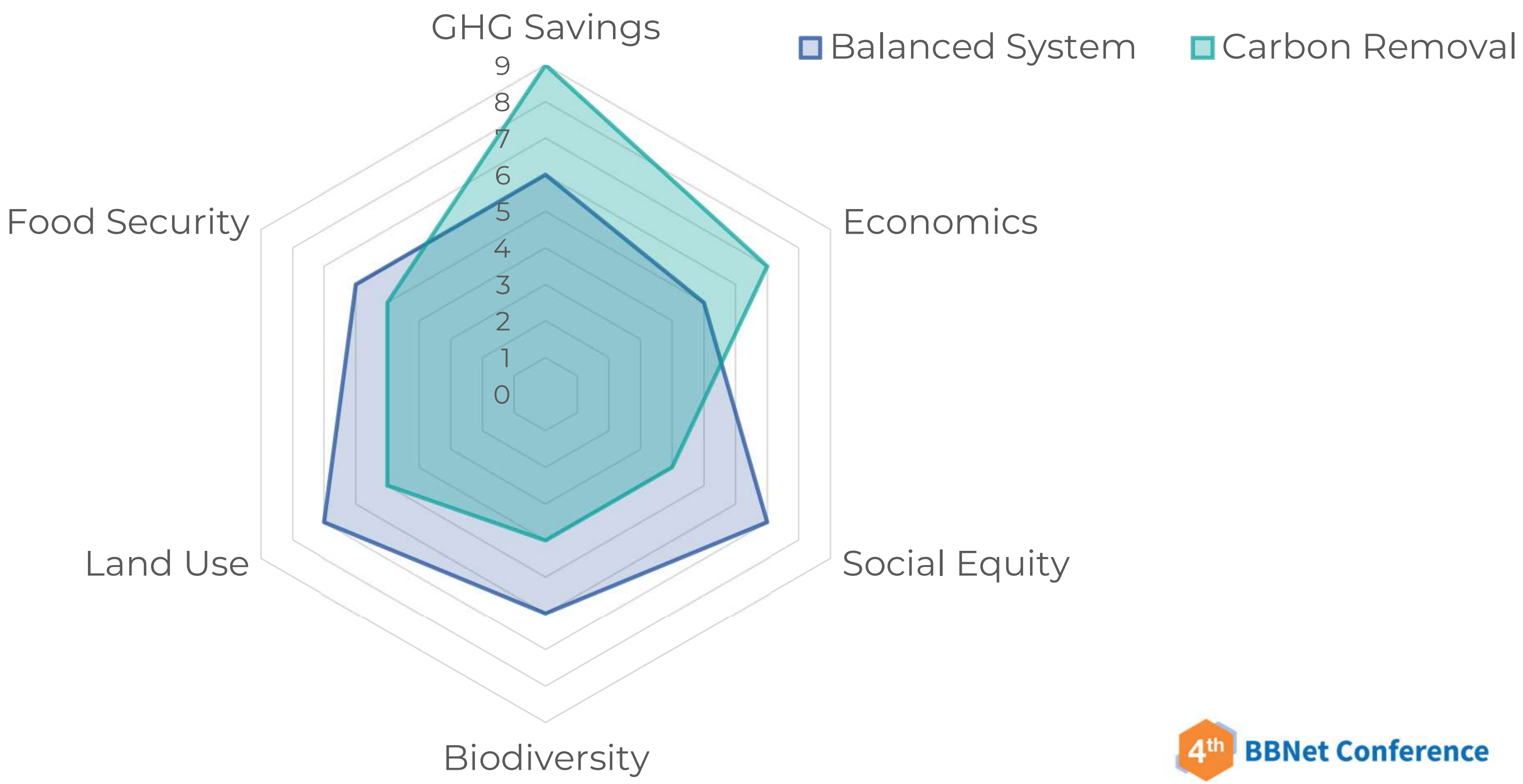
# Policy Scenario Trade-Offs



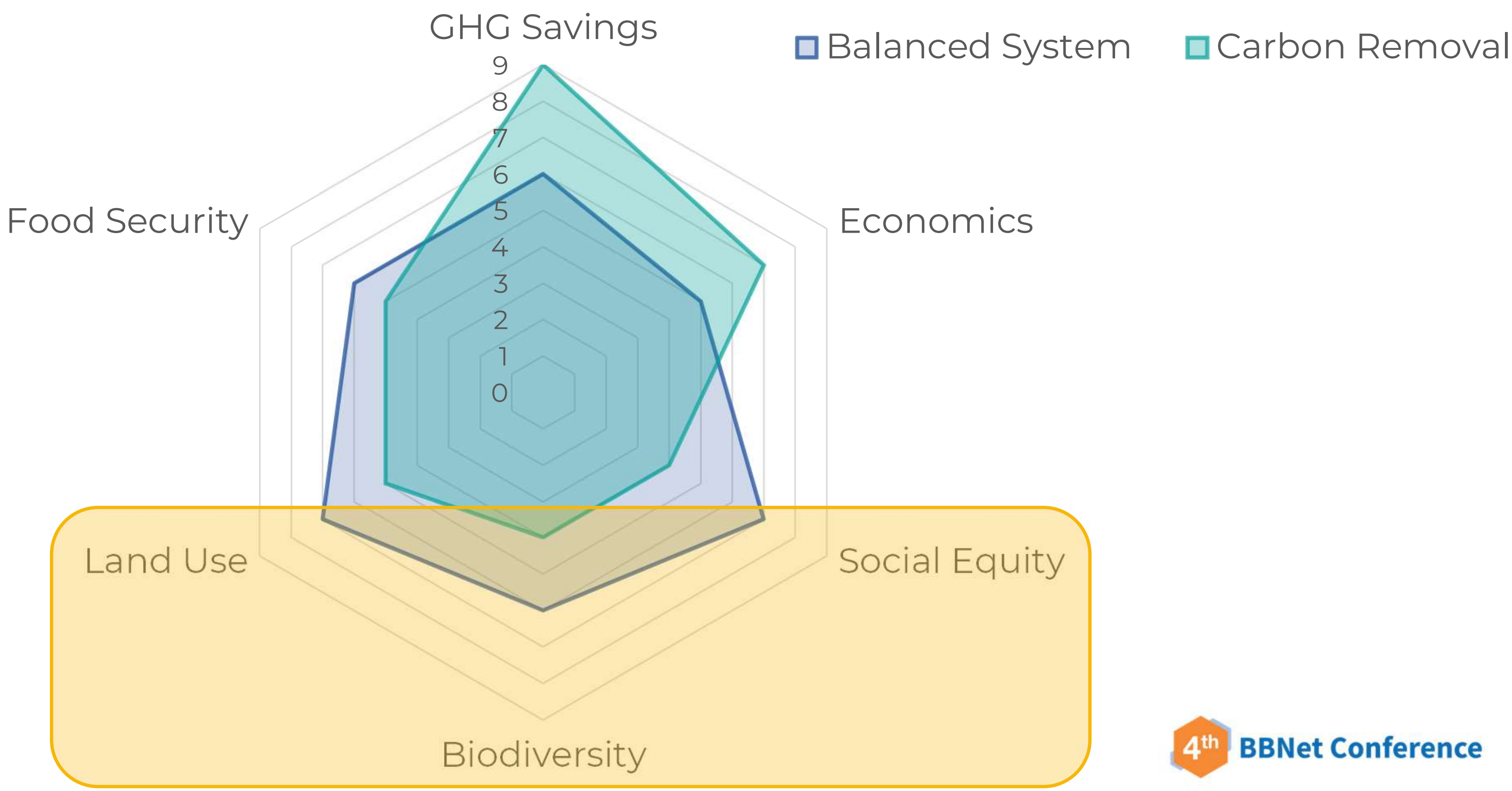
# Policy Scenario Trade-Offs



# Policy Scenario Trade-Offs



# Policy Scenario Trade-Offs



# Help us shape these scenarios

**Removals**

**Heat**

**Power**

**Biogas and Biomethane**

**Biofuels (including $H_2$)**


**Circular Bioeconomy**

## Supergen Bioenergy Hub Business Interaction Vouchers (**Deadline 31st October**)

- **Up to £15,000** to fund short-term projects.
- Build **new partnerships, accelerate research impact** and strengthen engagement between academia and industry.
- Support **energy and industrial priorities.**
- **Cover costs of developing a collaboration** with a university, eg consumable costs, researcher time, site visits.

## Supergen Bioenergy Hub member directory

bitly

- **Access to a specialised contact database** to connect with experts across the biomass and bioenergy space.
- Visibility in the member directory, so **others can search for and identify your areas of expertise.**
- Curated content, **tailored to your interests.**
- Options **to join stakeholder forums** to support wider impact.

Supergen Bioenergy

Aston University BIRMINGHAM UK

EBRI Energy & Bioproducts Research Institute


**Dr Daniel Taylor, Postdoctoral Researcher**

Systems Research Group, EBRI, Aston University

d.taylor4@aston.ac.uk

linkedin.com/in/danieljamestaylor/

BB Net Biomass Biorefinery Network

## Be sure to visit our exhibition throughout the conference

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Supergen Bioenergy

BDC Biorenewables Development Centre
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