efb | Biocatalysis

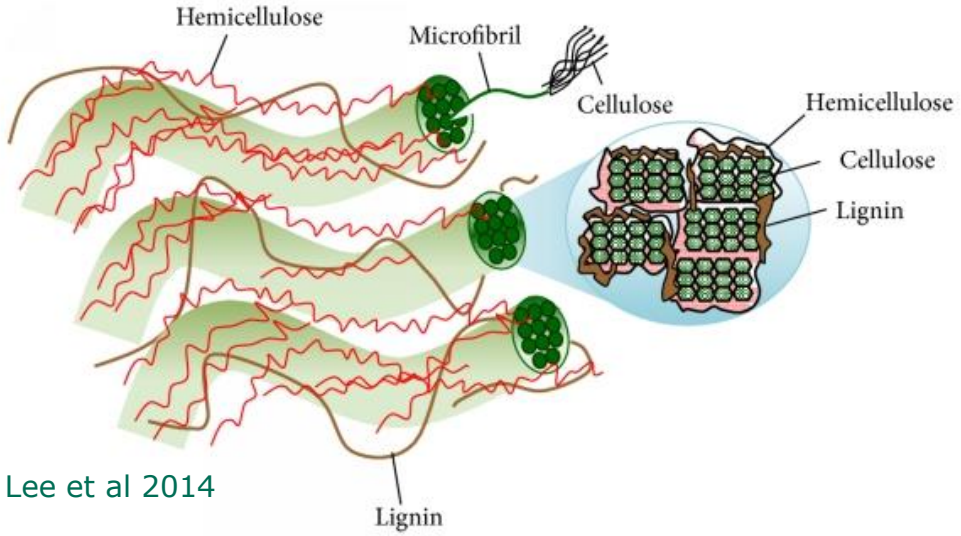
cbma centre of molecular and environmental biology

BERKELEY LAB

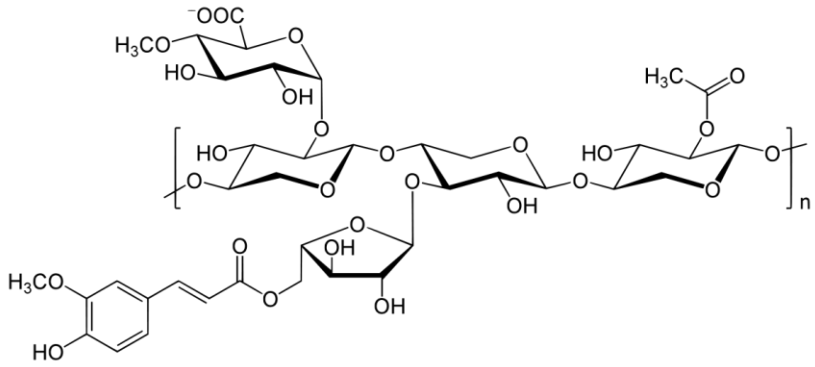
A novel D-xylose isomerase: from the gut of a wood feeding beetle for improved conversion in *Saccharomyces cerevisiae*

Paulo César Silva, Javier A. Ceja-Navarro, Flávio Azevedo, Ulas Karaoz, Eoin L. Brodie and Björn Johansson

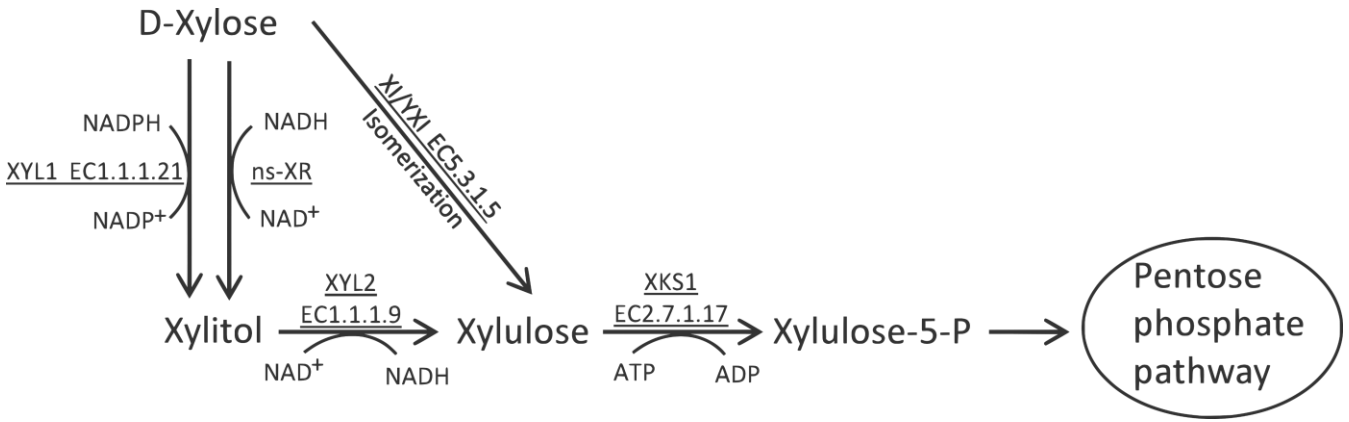
Lignocellulose – a valuable renewable raw material



Lee et al 2014



Xylan

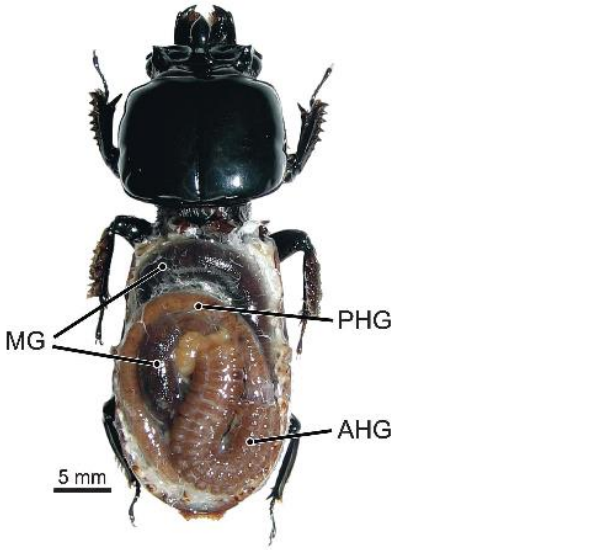


Feng et al 2018

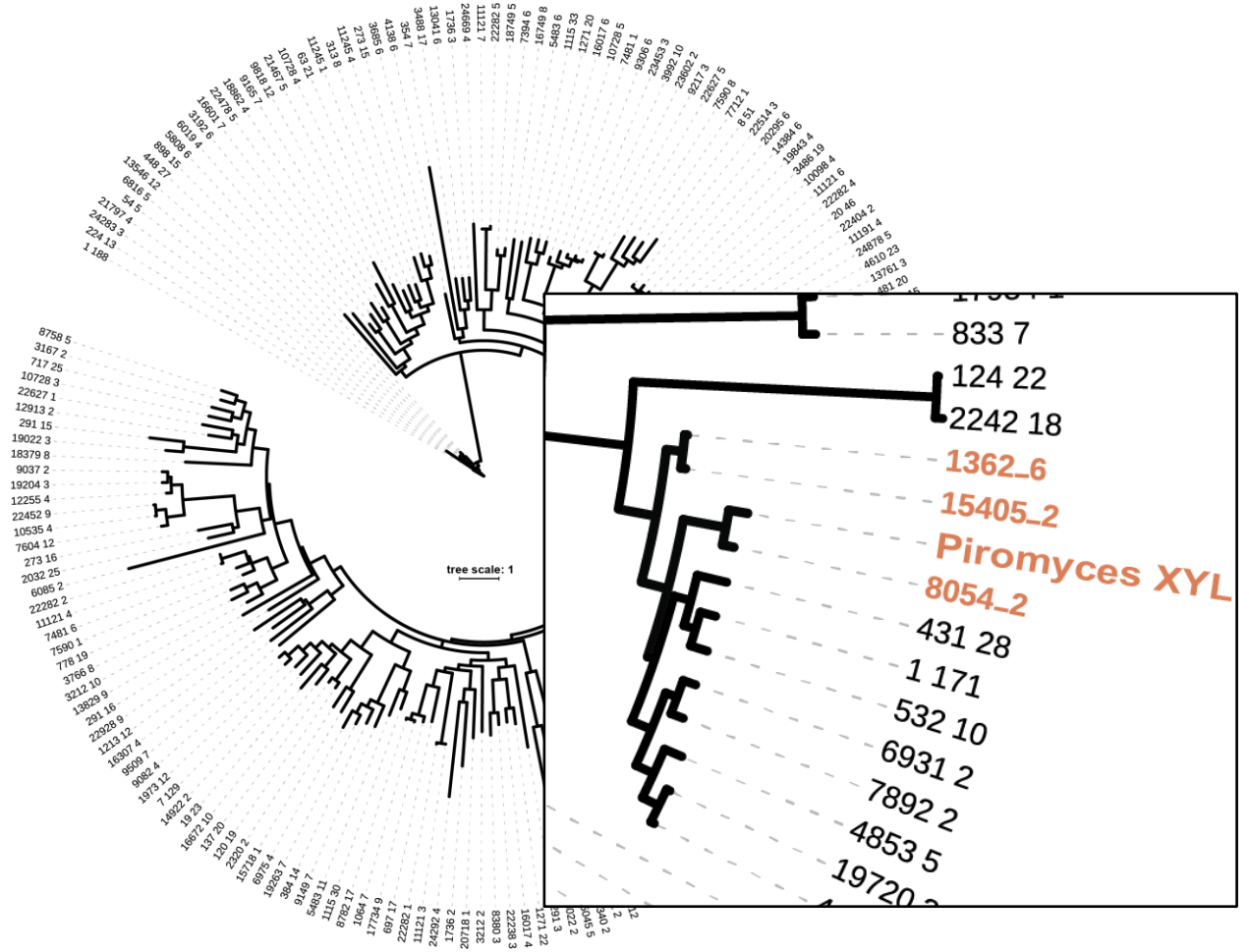
XR/XDH (D-xylose reductase/xylitol dehydrogenase) pathway suffers from NAD(P)H cofactor imbalance

XI (D-xylose isomerase) pathway suffers from low capacity and inhibition by xylitol

A source of D-xylose isomerases

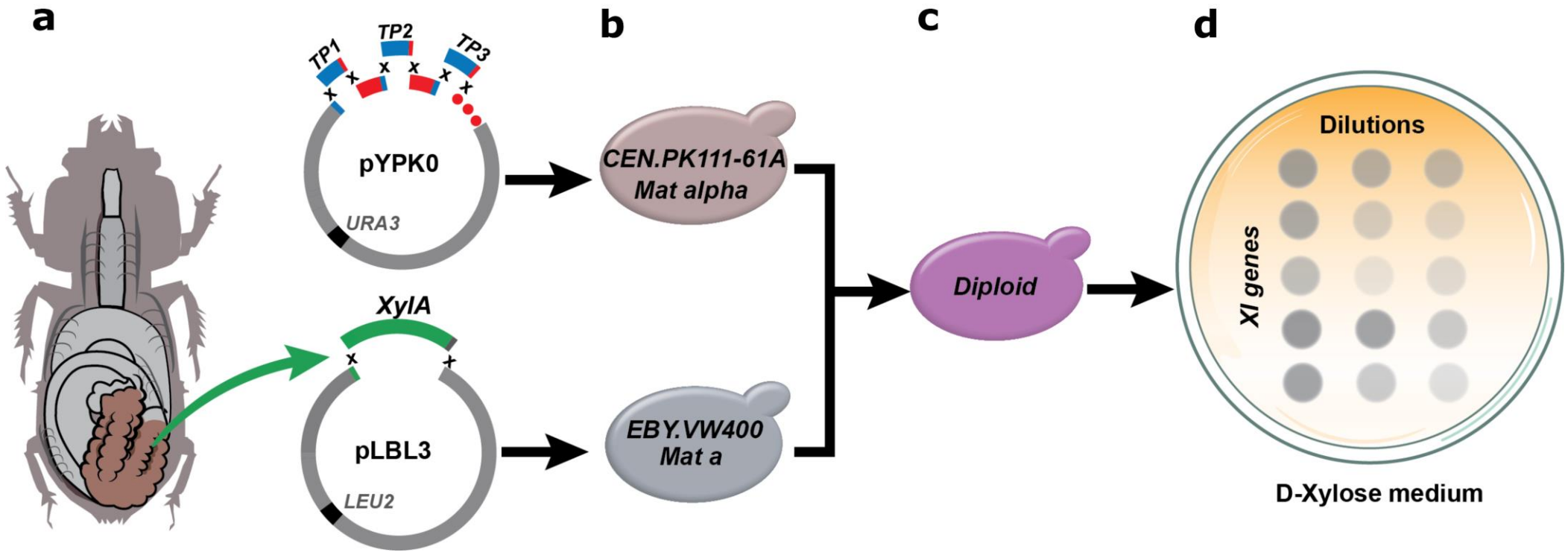


Odontotaenius disjunctus



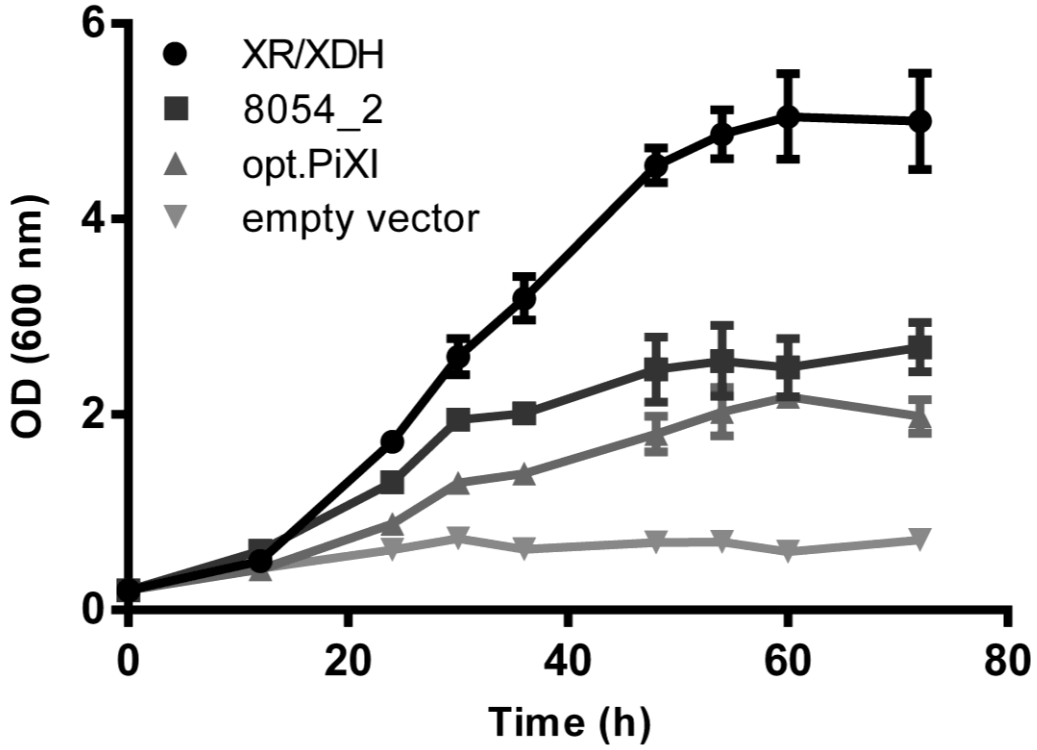
182 putative XIs

Functional screening



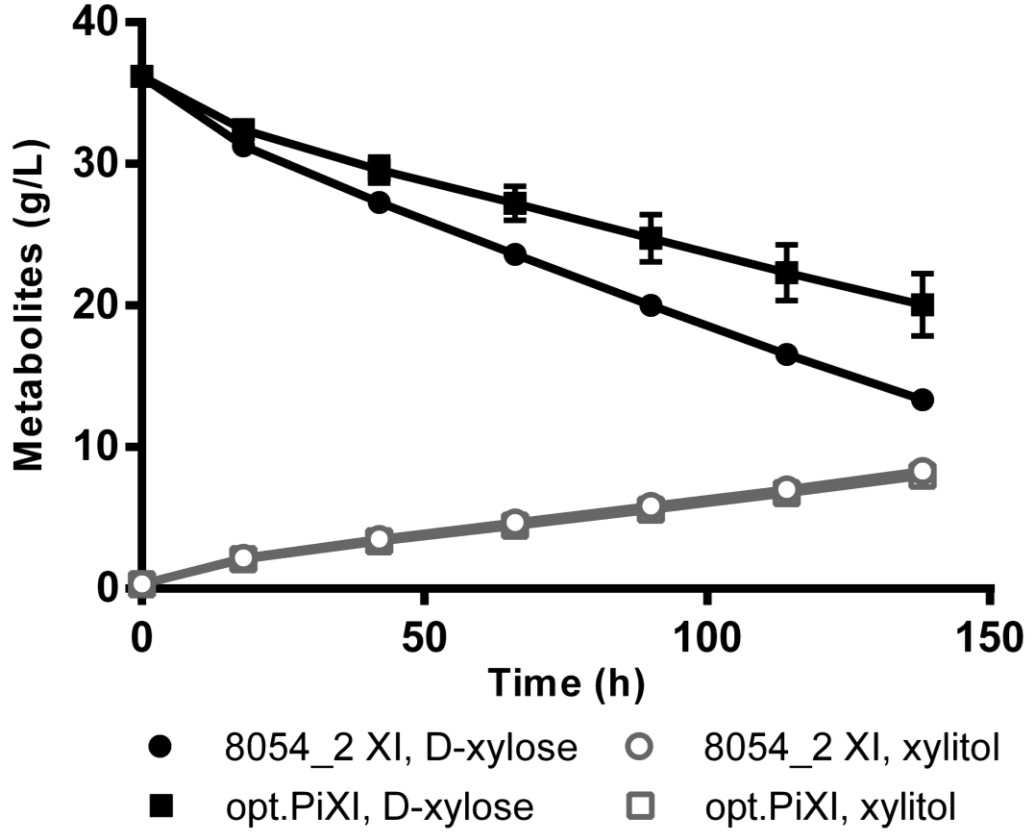
8054_2

Growth on and consumption of D-xylose



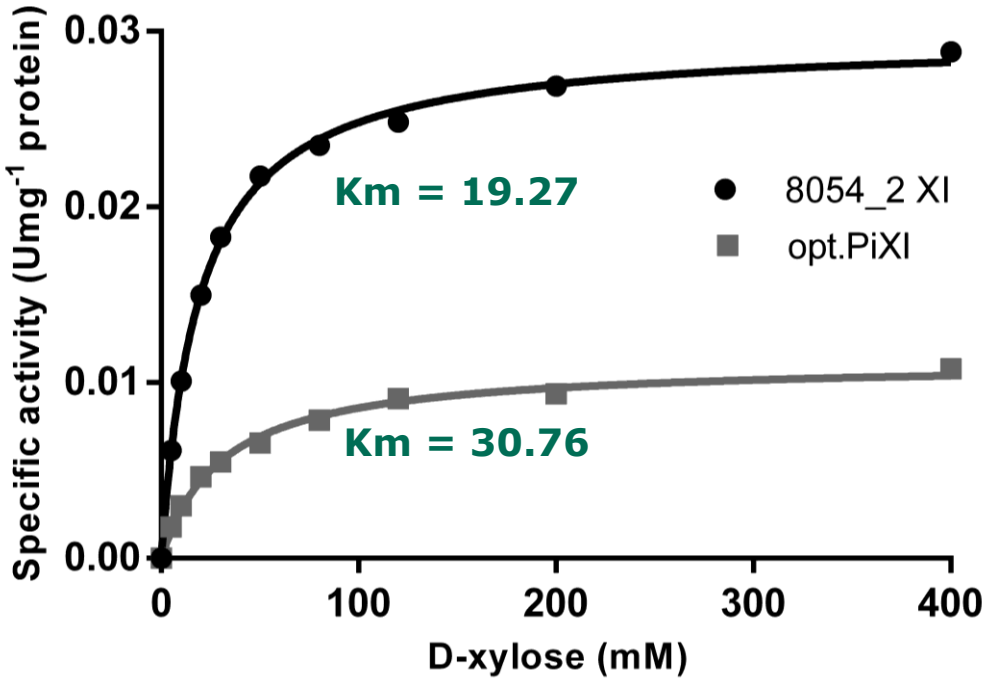
XR/XDH: 0.10 h^{-1} 8054_2: 0.06 h^{-1} opt.PiXI: 0.04 h^{-1}

⇒ **50% faster** aerobic growth



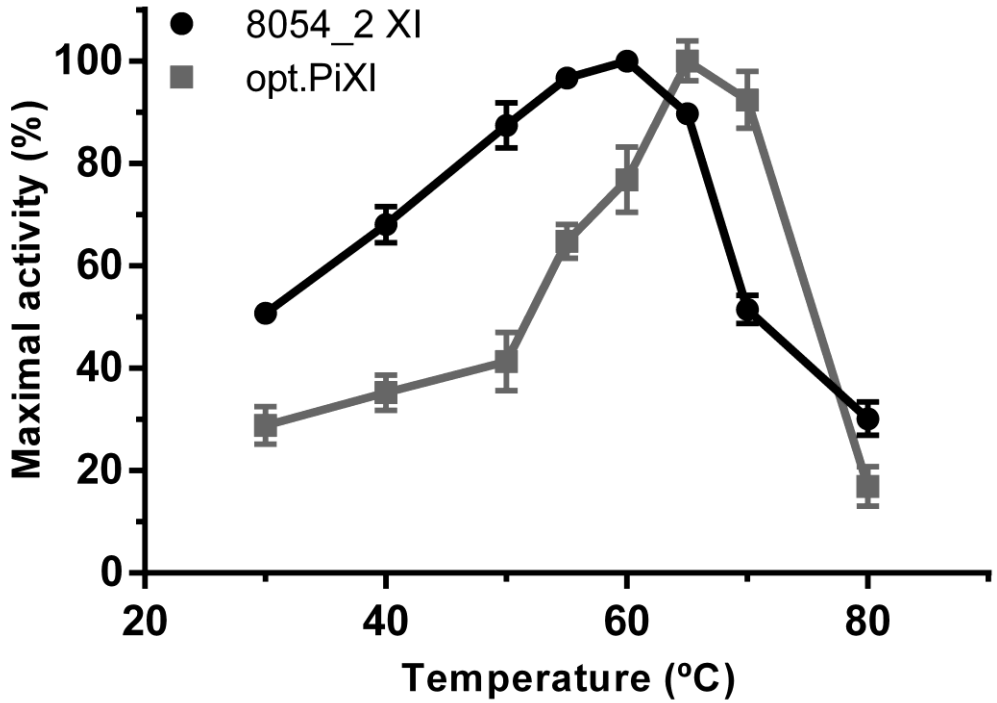
⇒ **72% higher** D-xylose isomerization rate

Kinetic parameters and optimal temperature



⇒ **2.6 times higher V_{max}**

⇒ **37% higher affinity**



⇒ 8054_2 retains **51% of maximal activity at 30 ºC** compared with only 29% activity for the *Piromyces* XI (opt.PiXI).

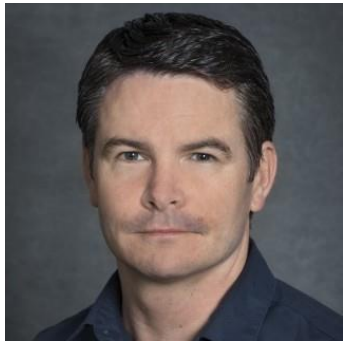
Highlights

⇒ The new enzyme, **8054_2**, showed higher specific activity and affinity for D-xylose than the current gold-standard from *Piromyces* sp., as well as substantially higher relative activity at 30 ºC.

⇒ The novel XI represents a highly valuable addition to the *S. cerevisiae* molecular toolbox and shows promise for improved industrial conversion of carbohydrate substrates.

Acknowledgements

Björn Johansson



Eoin Brodie

Javier Ceja-Navarro

Paulo César Silva, PhD student

pcfernandesdasilva@gmail.com

Department of Biology, University of Minho
Campus de Gualtar 4710-057 Braga, Portugal

https://metabolicengineeringgroupcbma.github.io