



Newsletter No.4 February 2024

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A research project funded under the EU H2020 programme, developing enzymes for environmental-friendly products

Welcome from the OXIPRO Project Coordinator, Dr. Gro Bjerga

#### Welcome to our 4th Newsletter

OXIPRO continues its steady progress, actively identifying new enzymes and optimizing existing versions for application across the four innovation cases in the project.

As we recently celebrated the International Day for Girls and Women in STEM research, we are showcasing the valuable contributions of our female researchers.



OXIPRO is dedicated to ensuring that our brilliant women are not only visible but also empowered and actively involved in the project through various approaches. We hope you find this issue of interest and we [welcome your feedback](#).

We also invite you to collaborate with us: to create change and to shape OXIPRO's developments and the future of enzyme applications. How can you do this? Simply [register via our website](#) to stay up-to-date with our activities and to take part in our events.

## News Summary

### Celebrating UN International Day of Women and Girls in Science



The theme for this year's International Day of Women and Girls in Science is 'Innovating for Sustainable Development: Access and Equity'. Yet, achieving gender equity in STEM research, entrepreneurship and innovation remains a challenge, according to the EC in a [recent report](#).

Did you know that the share of women in scientific advisory panels and as researchers in projects remains below the 50% target, at 43% and 23% respectively?

Read on...

## OXIPRO Researchers Announce Exciting New Oxidase Discoveries



**university of  
 groningen**

**New publications**



**Barcelona  
 Supercomputing  
 Center**  
 Centro Nacional de Supercomputación

**Great collaborations**

**FEBS Journal** **FEBS PRESS**  
 an online platform for research

**Discovery and structural characterization of a thermostable bacterial monoamine oxidase**

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**Keywords**  
 FAD; flavoenzyme; monoamine oxidase; n-alkylamines; n-heptylamine

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(Received 22 June 2023; revised 1 September 2023; accepted 29 September 2023)  
 doi:10.1111/febs.16072

Monoamine oxidases (MAOs) are pivotal regulators of neurotransmitters in mammals, while microbial MAOs have been shown to be valuable biocatalysts for enantioselective synthesis of pharmaceutical compounds or precursors thereof. To extend the knowledge of how MAOs function at the molecular level and in order to provide more biocatalytic tools, we set out to identify and study a robust bacterial variant: a MAO from the thermophile *Thermosphaerobacter* bacterium (MAO<sub>TB</sub>). MAO<sub>TB</sub> is highly thermostable with melting temperatures above 73 °C and is well expressed in *Escherichia coli*. Substrate screening revealed that the oxidase is most efficient with n-alkylamines with n-heptylamine being the best substrate. Presteady-state kinetic analysis shows that reduced MAO<sub>TB</sub> rapidly reacts with molecular oxygen, confirming that it is a *bona fide* oxidase. The crystal structure of MAO<sub>TB</sub> was resolved at 1.5 Å and showed an exceptionally high similarity with the two human MAOs, MAO A and MAO B. The active site of MAO<sub>TB</sub> resembles mostly the architecture of human MAO A, including the cystinyl protein-FAD linkage. Yet, the bacterial MAO lacks a C-terminal extension found in human MAOs, which explains why it is

Applied Microbiology and Biotechnology (2024) 108:9  
 https://doi.org/10.1007/s00253-023-12863-9

**BIOTECHNOLOGICALLY RELEVANT ENZYMES AND PROTEINS**

**Discovery and biochemical characterization of thermostable glycerol oxidases**

Lars L. Santema<sup>1</sup>, Laura Rotilio<sup>2</sup>, Ruite Xiang<sup>3</sup>, Gwen Tjallinks<sup>1</sup>, Victor Guallar<sup>3</sup>, Andrea Mattevi<sup>2</sup>, Marco W. Fraaije<sup>1</sup>

Received 23 June 2023 / Revised 10 October 2023 / Accepted 20 October 2023  
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**Abstract**  
 Aldol oxidases are promising tools for the biocatalytic oxidation of glycerol to more valuable chemicals. By integrating in silico bioprospecting with cell-free protein synthesis and activity screening, an effective pipeline was developed to rapidly identify enzymes that are active on glycerol. Three thermostable aldol oxidases from *Acetivibrio* bacterium, *Sterigmatomyces thermovividans*, and *Thermotoga* sp. *chromogena* active on glycerol were discovered. The characterization of these three flavoenzymes demonstrated their glycerol oxidation activities, preference for alkaline conditions, and excellent thermostabilities with melting temperatures higher than 75 °C. Structural elucidation of the aldol oxidase from *Acetivibrio* bacterium highlighted a constellation of side chains that engage the substrate through several hydrogen bonds, a histidine residue covalently bound to the FAD prosthetic group, and a tunnel leading to the active site. Upon computational simulations of substrate binding, a double mutant targeting a residue pair at the tunnel entrance was created and found to display an improved thermal stability and catalytic efficiency for glycerol oxidation. The hereby described aldol oxidases form a valuable panel of oxidative biocatalysts that can perform regioselective oxidation of glycerol and other polyols.

**Key points**

- Rapid pipeline designed to identify putative oxidases
- Biochemical and structural characterization of aldol oxidases



**monoamine oxidase**  
 *monoamine oxidase*



**glycerol oxidase**  
 *glycerol oxidase*

Researchers led by Prof. Marco Fraaije at the University of Groningen (RUG) have just published two papers describing the discovery and characterisation of two thermostable oxidases. The first of these was authored in collaboration with Barcelona Super Computing Centre, led by Victor Guallar.

### [Discovery and biochemical characterization of thermostable glycerol oxidases](#)

Lars L. Santema; Laura Rotilio; Ruite Xiang; Gwen Tjallinks; Victor Guallar; Andrea Mattevi; Marco W. Fraaije

### [Discovery and structural characterization of a thermostable bacterial monoamine oxidase](#)

Lars L. Santema; Lorenzo Basile; Claudia Binda; Marco W. Fraaije.

Read our output...

Kick-starting our Innovative Creativity with OXIPRO's Innovation Boot Camp

Companies and researchers depend on the ability to innovate in order to stay competitive. Innovation is traditionally thought to be associated with fun and creativity. However, innovation can be hard work that requires both willingness and the ability to generate ideas, and its purpose should focus on the “why” and not the “what” in order to sustain innovation in the long term.

One way in which OXIPRO is boosting innovation capacity for project and sister project members is through its Innovation Boot Camp (IBC), taking place on April 18th and 19th, 2024 in Berlin, Germany.

Members of the enzyme cluster projects will be working on exploitable results from our research and finding ways to bring our greener and more sustainable products to end-users.



[More info ...](#)

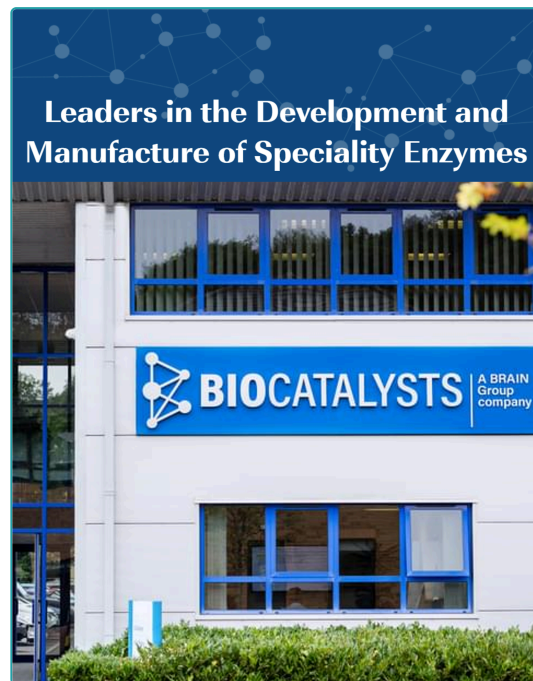
## Biocatalysts' Acquisitions Elevate it to Enzyme Partner of Choice

OXIPRO partner Biocatalysts Ltd has successfully completed the acquisition of Breatec, WeissBioTech and Biosun from its parent company BRAIN Biotech AG, creating the Bioproducts division under the Biocatalysts brand.

This latest acquisition means that Biocatalysts Ltd is even better positioned to continue to drive profitable growth and expansion within the Food, Beverage, and Life Science industries as the enzyme partner of choice.

Among its many roles in OXIPRO, Biocatalysts helps steer our work towards industrial relevance; it supports the cloning of enzymes into various hosts, and through its proprietary MetXtra™ platform it helps predict the optimal expression systems to be used for different enzyme types and sequences. It offers partners best-in-class enzyme metagenome discovery as well as strain and protein-engineering capabilities.

[Find out more...](#)



## NORCE Research Opportunities – Don't Miss Out!



OXIPRO Project Coordinator, NORCE, has announced two job opportunities – [the application deadlines are 18th February!](#)

The posts are for a permanent, full-time research scientist position and a permanent, full-time research technician position.

In both roles, you are expected to be a key contributor to the fermentation work optimizing scale-up of fermentations from flasks through >1000 L industrial reactors, developing the knowledge and skills necessary to support this work at each step.

Both posts are based in the Industrial Biotechnology research group based in Stavanger.



[Read on and apply...](#)

## Meet the Team – How REDINN Reinforces OXIPRO'S Innovation Strategies



We regularly introduce you to one of our project partner organisations. In this issue, it's the turn of REDINN.

Headquartered in Rome, [RETE EUROPEA DELL'INNOVAZIONE](#) (REDINN) is a high-growth knowledge intensive consulting company that collaborates with European and international companies and research centres.

The REDINN team dedicated to OXIPRO has a number of pivotal tasks: Informing Policymakers; Social and Economic Sustainability Assessment; and Boosting Impact through Communication and Dissemination

Leonardo Piccinetti said: "REDINN is proud to be a key partner in such an innovative initiative. We will ensure that OXIPRO's research developments and outcomes have the desired impact in policy, research, and industry – and in the uptake of more sustainable, environmentally friendly consumer products'.

[Find out more...](#)

## Collaborating with our Sister Projects

OXIPRO partners continue to work closely with partners in our three sister projects to tackle common problems and contribute to the call's expected outcomes. **Our sister projects are:**

- [EnXylaScope](#)
- [FuturEnzyme](#)
- [Radicalz](#)



Find out more about the recent output from our enzyme cluster's joint undertakings:

- [Enzyme Cluster Projects Present Innovations in Enzyme Research in Europe.](#)



- [Enzyme Cluster Projects Review the Consequences of Climate Change and How Enzymes Can Counteract](#)

You can also read more about our activities and developments in our joint newsletter - [The Active Site](#)

- [Latest edition the Enzyme Cluster's Joint Newsletter The Active Site #6](#)
- [Subscribe to The Active Site](#)

## And finally...

We hope you've found this issue of OXIPRO'S news of interest.

Please [register via our website](#) to stay up to date with our developments and to take part in our events.

We hold stakeholder consultations with representatives from different fields who assist us in filling knowledge gaps and identifying requirements.

If you want to know how we engage those interested in OXIPRO, we've taken a "scientific approach" and [published our guide](#) on how to develop a stakeholder engagement plan.



[www.oxipro.eu/contact/](http://www.oxipro.eu/contact/)

## About OXIPRO

OXIPRO is a four-year initiative funded under the EU's Horizon 2020 programme and brings together a multidisciplinary team of researchers and stakeholders from 15 entities across Europe to focus on the development of novel enzymes for environment-friendly consumer products.

The OXIPRO partners are developing and deploying an efficient oxidoreductase foundry using cutting-edge bioinformatics and biotechnology, and by broadening the range of industrial oxidoreductases for more sustainable processes, this initiative will ultimately contribute to the transition to environment-friendly products, with detergents, textiles, sunscreens, and nutraceuticals.

Through the integration of computational workflows and state-of-the-art biotechnological technologies, OXIPRO will expedite the lab to market journey, while shortcutting downstream implementation and ensuring market uptake. This will be supported by ecosystem intelligence generated throughout the project as well as engagement with research, policy, societal and industrial actors in co-creation and interactions to maximise output and enable faster and systemic innovations.

For more information, contact:

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To join the OXIPRO Community and receive project updates, [please register here](#)

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000607.



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