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Arginine-terminated LPMOs: a new face in biomass breakdown? Follow-on studies

"The new form of LPMO enzymes is intriguing as it does not contain the usual amino acids at its active site, suggesting that it could be active on a new range of biomass components." **Paul Walton, University of York**

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The overall structure of a typical LPMO has an extended flat face in the middle of which lies the enzyme's active site, containing copper ion coordinated by a N-terminal histidine. A new type of LPMO has a conserved N-terminal arginine instead of an N-terminal histidine.

OUTCOMES: In this project we examined the activity of this new LPMO using ultraviolet–visible spectroscopy and electron paramagnetic resonance. We also determined the structure of the enzyme, gaining particular insight into how it interacts with its substrates. This finding opens up the possibility of tailoring the enzyme to carry out new types of reactions which are of importance to biomass degradation. While we cannot report the details of the findings due to IP reasons, the project was successful in that we developed a new type of assay for this class of enzymes and we also demonstrated that the LMPOs had a new type of enzymatic activity on a range of substrates.

INITIAL AIMS: The generation of fuels and commodity chemicals from sustainable biomass hinges on a single key issue: that biomass (e.g. wood, plant matter) is very hard to break down in a controlled manner. The use of copper-containing lytic polysaccharide monooxygenases (LPMOs) — natural enzymes that are highly efficient at breaking down cellulose — could help circumvent this. In this project, we seek to maximise the ability of a new type of LPMO to break down woody biomass. Our previous Metals in Biology-funded studies showed that this new LPMO can bind metal ions, and we have also obtained a full molecular structure of the enzyme using X-ray diffraction. The structure of this new class of LPMOs suggests that they could be active on lignin and/or lignin components and that, indeed, these LPMOs use metal ions as part of their catalytic cycle. If true, this would represent a wholly new activity for LPMOs and be an exciting addition to the field of biomass degradation.

- **The partners are in discussions on how to take the project forward**