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The role of H_2O_2 in biomass conversion: New enzymatic mechanisms, new processes

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The conversion of (plant) biomass is central in the Earth´s carbon cycle and relies on a network of enzymatic and chemical reactions. However, a complete picture of this process is not available yet. The discovery of lytic polysaccharide monooxygenases (LPMOs) in 2010 has dramatically changed our understanding of biomass conversion in nature and facilitated the development of economically sustainable lignocellulose bio refineries. LPMOs are mono-copper redox enzymes that attack the most recalcitrant/insoluble parts of biopolymers such as cellulose or chitin, making the substrate more tractable to the action of canonical glycoside hydrolases. Despite their key roles in biomass conversion and their abundance in nature, the mode of action of LPMOs has remained obscure. The dependence on O_2 and electrons led the scientific community to consider LPMOs as monooxygenases. This has greatly influenced the design of basic studies, the understanding of the interplay between LPMOs and other enzymes as well as the harnessing of LPMOs in applied settings. In 2016, we have discovered that LPMOs use H_2O_2 and not O_2 as co-substrate. This paradigm-shattering discovery has led us to re-consider many aspects of LPMOs catalysis. In this presentation, we will present our most recent results describing in-depth characterization of the new H_2O_2-based mechanism, studied by biochemical and computational approaches. We have also investigated the role of other redox enzymes involved in biomass decay and their partnership with LPMOs. Finally, we will discuss how changes in the mechanistic paradigm may translate into the industrial application of these powerful and unusual enzymes.

Biography

Bastien Bissaro has completed his PhD from the University of Toulouse (France) and obtained a Marie Curie-AgreenSkills Postdoctoral Grant to study LPMOs in the group of Professor V Eijsink, at NMBU (Norway). He is currently conducting a Post-doctoral project to decipher the H_2O_2-based LPMO mechanism under the guidance of Dr. Å K Røhr, at NMBU. He is the author of more than 15 papers, 15 conference communications, one patent and recipient of several conference presentation awards.

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