From a danger signal to the biosynthesis of novel phenolic compounds

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Plant cell wall is an extracellular matrix composed of polysaccharides, polyphenols and proteins. The enzymatic hydrolysis of cell wall polysaccharides results in the production of oligosaccharides with nature of damage-associated molecular patterns (DAMPs) that are perceived by plants as danger signals[1]. Oligosaccharide-oxidases (OSOXs), flavoenzymes belonging to the sub-family of "berberine bridge enzyme-like proteins", oxidize these oligosaccharides by quenching their DAMP action and concomitantly converting molecular O_2 into H_2O_2[2-4]. Here we show a novel reaction mechanism through which the oxidizing activity on short oligosaccharides, instead of producing H_2O_2, led to the reduction of oxidized phenols (bi-phenoquinones), highlighting a possible application of OSOXs in synthetic biology[5]. By combining the oxidative-polymerizing activity of metalloenzymes on simple phenolics and the reducing activity of OSOXs on bi-phenoquinones, we succeeded at synthetizing a variety of novel oligo-phenols potentially exploitable in different industrial sectors.

Keywords: plant cell wall, DAMPs, oligosaccharide oxidase, bi-phenoquinone, oligo-phenols, synthetic biology.

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