Transformation of CO_2 into carbohydrates: A story of boron and cascade

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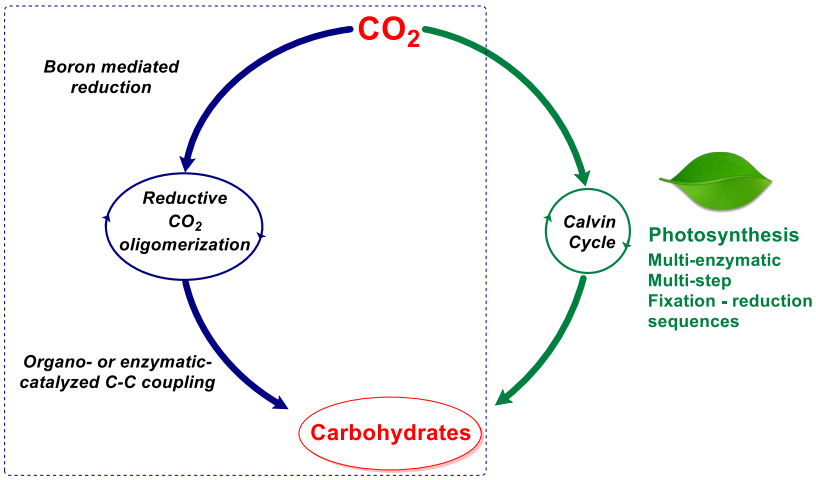
In the context of transforming CO_2 into complex products, photosynthesis is a fascinating process that transforms CO_2 into carbohydrates. In absence of any bio-machinery, however, this transformation is a great synthetic challenge, implying the formation of polyol chain and of asymmetric carbon atoms from CO_2 as the only source of carbon.

Few years ago, we started to study the hydroboration of CO_2[1] and notably reported its controlled 4 electron reduction into a bis(boryl)acetal compound. With a one-pot two-step strategy, this borylated intermediate was subsequently used as a C_1 source for the synthesis of a large variety of products featuring new C-N, C-O and C-C bonds.[2] Using similar cascade strategy, we then turned our attention to using these intermediates as C_n sources to generate carbohydrate. I will present how in different conditions and with the key help of organo- or enzymatic catalysts, we were able to control the C-C bond formation steps to generate C_2, C_3 and C_4 carbohydrates selectively with stereocontrol.[3]



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