Dissimilatory sulfate reduction is a four-step pathway

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The dissimilatory sulfite reductase (DsrAB) is one of the most important enzymes in the biogeochemical sulfur cycle, being present in all sulfur-metabolizing organisms. This enzyme catalyzes the reduction of sulfite, but despite years of research, the mechanism and products of sulfite reduction were not clear. *In vitro* DsrAB produces a mixture of products including thiosulfate and trithionate, while the closely-related assimilatory enzyme reduces sulfite directly to sulfide. The reduction of sulfite by DsrAB also involves the small protein DsrC and the DsrMKJOP membrane complex [1]. DsrC is a highly abundant protein that contains two conserved redox-active cysteines in a flexible C-terminal arm. We studied the impact of this protein and its conserved Cys on sulfite reduction, using *in vivo* and *in vitro* experiments. Our results show that DsrC plays a major role in sulfite reduction by increasing the activity of DsrAB without formation of sub-products [2]. Instead a DsrC trisulfide is formed as product, showing that the sulfate reduction pathway is a four-step process, unlike previously considered. Additionally, we show that the DsrC last cysteine is essential and clarify the mechanism of this important reaction. Physiological studies also showed that when DsrC expression is reduced, this directly affects sulfate reduction rates and cell densities indicating that reduction of the DsrC trisulfide by the respiratory membrane complex DsrMKJOP is associated with energy conservation. Finally, we investigated how the levels of DsrC and its cysteines affect sulfur and hydrogen isotopic fractionation [3].

[1] Venceslau et al., 2014, Biochim Biophys Acta 1837, 1148
[2] Santos, Venceslau, et al., 2015, Science, 350, 1541
[3] Leavitt et al., 2016, FEMS Microbiol Lett, 363