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Electron Flow in Cytochrome c_3 Mutant of *Desulfovibrio desulfuricans* G20.

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The sulfate-reducing bacteria (SRB) have an enormous impact environmentally and economically in biocorrosion of metals, bioremediation of toxic compounds and mineralization of biomass. The versatility of SRB energy generating processes makes these activities possible. A “hydrogen-cycling” model was proposed over twenty years ago to explain how these bacteria may augment energy generation during respiration. Cytochrome c_3 is a key to the proposed route of electron flow. A mutant of *Desulfovibrio desulfuricans* G20 that lacks functional cyt c_3 produces a significant portion of the reductant generated from lactate oxidation as hydrogen. The absence of cyt c_3 apparently blocks reoxidation. Resultant growth yields of the mutant are reduced, reflecting this inefficiency in electron utilization. Measurements of total cell protein and reductant balance of the mutant versus the wild-type reveal differences in the route of electron flow during reduction of sulfate versus sulfite to hydrogen sulfide. With sulfite as terminal electron acceptor for wild type growth on lactate, there is about a 50% increase in cell mass reflecting the sparing of two ATP equivalents needed for sulfate activation. In contrast, the cyt c_3 mutant does not grow at all on lactate/sulfite medium indicating that the electrons from lactate oxidation are not available for sulfite reduction. However, with pyruvate as the electron donor, the mutant does reduce sulfite. Thus cyt c_3 appears necessary for wild type growth on lactate/sulfite or pyruvate/sulfate medium suggesting that an electron transfer step in the periplasm is involved in these pathways that cannot be completely bypassed. Additional information on substrate utilization possibly will lead to insight into compensatory changes in protein expression of cyt c_3 mutant and to further understanding of the function of cyt c_3 in electron flow in G20.