Spectroscopic/Computational Insights into the Biosynthesis and Reactivity of Coenzyme B_{12}

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The B_{12} cofactor adenosylcobalamin (coenzyme B_{12}; the biologically active form of vitamin B_{12}) has long fascinated chemists with its unparalleled structural complexity and unusual reactivity in biological systems, involving homolytic cleavage of the organometallic Co–C bond to produce Co^{2+}-cobalamin and an adenosyl radical. We utilize a combined spectroscopic/computational methodology to explore two fundamentally different, though complementary, aspects of B_{12} research; namely, the mechanism of biological Co–C bond *formation* in the adenosylcobalamin biosynthesis and the factors by which B_{12}-dependent enzymes accelerate the rate of homolytic Co–C bond *cleavage* by ~12 orders of magnitude without significantly enhancing undesired Co–C bond heterolysis.

Representative Publications

[1] Stich, T. A.; Brooks, A. J.; Buan, N. R.; Brunold, T. C. *J. Am. Chem. Soc.* **2003**, *125*, 5897-5914; [2] Brooks, A. J.; Vlasie, M.; Banerjee, R.; Brunold, T. C. *J. Am. Chem. Soc.* **2004**, *126*, 8167-8180; [3] Stich, T. A.; Buan, N. R.; Brunold, T. C. *J. Am. Chem. Soc.* **2004**, *126*, 9735-9749; [4] Stich, T. A.; Yamanishi, M.; Banerjee, R.; Brunold, T. C. *J. Am. Chem. Soc.* **2005**, *in press*; [5] Stich, T. A.; Buan, N. R.; Escalante-Semerena, J. C.; Brunold, T. C. *J. Am. Chem. Soc.* **2005**, *in press*.