

Biologically active forms of vitamin B₁₂, such as methylcobalamin (MeCbl) or coenzyme B₁₂ (AdoCbl), are highly complex, naturally occurring organometallic compounds that contain a unique Co-C bond. MeCbl and AdoCbl serve as cofactors for a series of enzymes that catalyze complex molecular transformation. In particular, MeCbl is the cofactor in a class of enzymes that catalyze the intermolecular methyl (Me) transfer reactions (methylation). These enzymes are commonly referred as corrinoid-dependent methyltransferases (MeTrs). MeTrs play a critical role in one-carbon metabolism and CO₂ fixation in anaerobic microbes as well as in amino acid metabolism in several organisms including mammals and bacteria. The principal objective of this research is to develop a unified mechanism of methyl transfer reactions catalyzed by MeTrs. Finally, it needs to be emphasized that methylation is one of the most essential functions of living organisms and deficiency of this reaction is responsible for a number of human disorders.