

YZGD FROM *PAENIBACILLUS THIAMINOLYTICUS*, A NOVEL PYRIDOXAL PHOSPHATASE OF THE HALOACID DEHALOGENASE (HAD) SUPERFAMILY AND NOVEL CDP-ALCOHOL, TDP-SUGAR, AND ADP-X HYDROLASE OF THE NUDIX HYDROLASE SUPERFAMILY. I. Tirrell, C. Daley, S. Denial, and S. O’Handley*, Department of Chemistry, imt1309@rit.edu, cjd4654@rit.edu, sjd1050@rit.edu, sfosch@rit.edu

YZGD from *Paenibacillus thiaminolyticus* is both a member of the Haloacid Dehalogenase (HAD) superfamily with phosphatase activity specific for pyridoxal phosphate as well as a member of the Nudix Hydrolase superfamily with activity on a number of Nudix substrates including CDP-alcohols, TDP-sugars, ADP-sugars, and ADP coenzymes, and to a lesser extent GDP-sugars and UDP-sugars. The HAD superfamily is a ubiquitous superfamily with a wide variety of hydrolases especially phosphatases. The Nudix Hydrolases degrade substrates consisting of a nucleoside diphosphate linked to some moiety, x, hence the acronym “NUDIX”. YZGD is the only enzyme known to belong to both superfamilies. YZGD is also the only identified Nudix hydrolase with the ability to hydrolyze derivatives of all of the nucleotides. Thus it is interesting to speculate that YZGD is an evolutionarily ancient Nudix hydrolase with rather non-specific activity from which evolved all of the more specific Nudix hydrolases seen today. The pyridoxal phosphatase activity is optimized with 5 mM Co^{+2} at pH 5, while the Nudix activity is Mn^{+2} specific with optimal activity at pH 8.5, yet both activities can be achieved at pH 7. YZGD may be important in nucleotide salvage generating the NMPs necessary for RNA and DNA biosynthesis.