DNA REPLICATION MECHANISM: EFFECTS OF SOLVATION, PI-STACKING, AND HYDROGEN BONDING ON THE SELECTIVITY

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DNA replication is at the core of life and an increasing number of studies aims at unraveling the mechanism of this complex biochemical reaction that, in spite of much effort, is still incompletely understood. In the present study, we aim at obtaining a better understanding of how the selectivity for the formation of a Watson-Crick over a mismatched base pair is achieved during DNA replication. We uncover and quantify the effects on this process of solvation, π-stacking and hydrogen bonding. This is done using state-of-the-art density functional theory in a QM/QM approach. Our work confirms that a certain extent of selectivity remains even in the absence of the polymerase enzyme. At the same time, we also provide evidence for an amplification of selectivity through a steric mechanism that has been attributed to the working of polymerase.