

Nucleotide elongation in reverse (3' - 5') direction

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Chains of nucleotide such as DNA and RNA are synthesized in one particular direction (5' - 3') but not the other. Because two chains of a double stranded DNA are aligned in the opposite direction to each other, things get complicated. One of the big questions in biology has been why cells don't have a reverse-direction enzyme so that both chains can be synthesized efficiently". Recently, a group of enzymes, called Thg1-like proteins (TLPs), was discovered that can add nucleotides in the reverse (3' - 5') direction to repair the damaged RNAs. We determined the structures in complex with intermediate tRNA/tRNA-GDPNP, and revealed that the reaction of TLP occurs in two-step manner at a reaction center; recruitment of energy supplying molecules (GTP/ATP), and then addition of nucleotide. What was unique to the reverse reaction was the recruiting energy at the beginning. The enzyme apparently utilizes this energy recruitment to switch the direction from forward to reverse. The enzyme apparently utilizes this bent structure to switch the direction from forward to reverse.

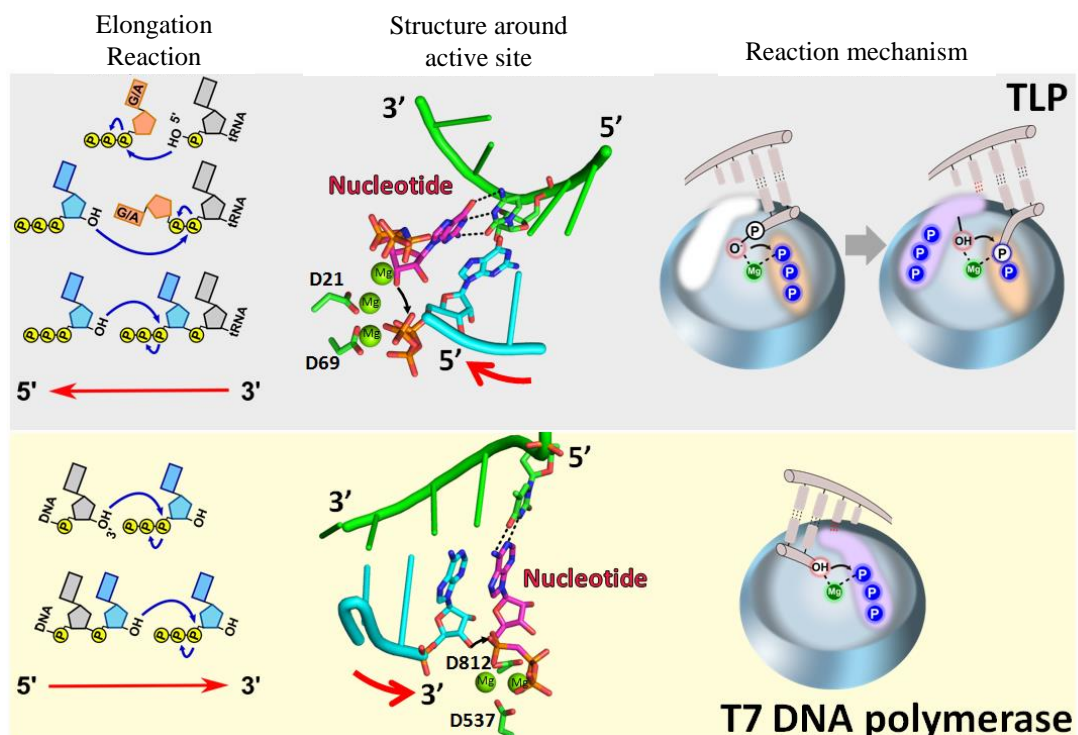


Figure 1. Reaction mechanism of TLP and T7 DNA polymerase