

During DNA replication, both strands of the double helix act as templates for the formation of new DNA molecules. Copying occurs at a localized region called the replication fork, which is a Y shaped structure where new DNA strands are synthesized by a multi-enzyme complex. Here, the DNA to be copied enters the complex from the left. One new strand is leaving at the top of frame, and the other new strand is leaving at the bottom. The first step in DNA replication is the separation of the two strands by an enzyme called helicase. This spins the incoming DNA to unravel it at 10,000 rpm, in the case of bacterial systems. The separated strands are called 3' and 5'; distinguished by the direction in which the component nucleotides join up. The 3' DNA strand, also known as the leading strand, is diverted to a DNA polymerase and is used as a continuous template for the synthesis of the first daughter DNA helix. The other half of the DNA double helix, known as the lagging strand has the opposite orientation and consequently requires a more complicated copying mechanism. As it emerges from the helicase the lagging strand is organized into sections called Okazaki fragments. These are then presented to a second DNA polymerase enzyme in the preferred 5' to 3' orientation. These sections are then effectively synthesized backwards. When the copying is complete, the finished section is released and the next loop is drawn back for replication. Intricate as this mechanism appears, numerous components have been deliberately left out to avoid complete confusion. The exposed strands of single DNA are covered by protective binding proteins and in some systems, multiple Okazaki fragments may be present.