



The Role of Polymerase Chain Reaction in DNA Sequencing

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DESCRIPTION

Polymerase Chain Reaction (PCR) is a technique for amplifying DNA sequences by replicating a target region many times. By allowing researchers to amplify and sequence particular areas of DNA from a range of samples, including blood, tissue, and environmental samples, PCR has revolutionized DNA sequencing.

Prior to sequencing, PCR is frequently used to amplify specific sections of DNA. This method is known as targeted sequencing, and it allows researchers to concentrate their efforts on certain genes or regions of interest. Sanger sequencing and Next-Generation Sequencing (NGS) are PCR-based sequencing technologies that have enabled the detection of disease-causing mutations, genetic variants, and microbial infections.

Examples of PCR applications in DNA sequencing

Forensic science: Based on DNA evidence, PCR has become a routine tool in forensic science for identifying suspects and victims. PCR-based technologies may amplify and compare small amounts of DNA from biological materials such as blood, sperm, and hair follicles. Polymerase Chain Reaction (PCR) is a innovative method that has revolutionized molecular biology by allowing researchers to amplify and examine specific DNA sequences. In DNA sequencing, PCR has a wide range of applications, including gene sequencing, disease diagnosis, forensic analysis, and environmental monitoring. Here are some of the most important PCR applications in DNA sequencing.

Targeted sequencing: Prior to sequencing, PCR is frequently used to amplify specific areas of DNA. This method is known as targeted sequencing, and it allows researchers to concentrate their efforts on certain genes or regions of interest. Sanger sequencing and next-generation sequencing are PCR-based sequencing technologies that have enabled the detection of disease-causing mutations, genetic variants, and microbial infections. Targeted sequencing can also be used to investigate the role of certain genes in disease aetiology or medication response.

Forensic science: Based on DNA evidence, PCR has become a routine tool in forensic science for identifying suspects and victims. Small amounts of DNA from biological materials such as blood, sperm, and hair follicles can be amplified using PCR and compared to a reference DNA profile. In forensic laboratories, PCR-based DNA sequencing technologies such as Short Tandem Repeats (STR) analysis are routinely employed to identify and match DNA samples.

Disease diagnosis: PCR has revolutionized infectious disease diagnosis by allowing for the quick and sensitive detection of microbial pathogens in clinical samples. In clinical laboratories, PCR-based technologies such as real-time PCR and Reverse Transcription-PCR (RT-PCR) are commonly used to detect viruses, bacteria, and parasites. These approaches are highly sensitive and specific, detecting as few as 10 to 100 copies of the target DNA or RNA. By detecting disease-causing mutations in specific genes, PCR-based technologies can also be used to diagnose genetic illnesses.

Environmental monitoring: PCR has also become a useful technology for detecting the presence of certain DNA sequences in environmental materials. Bacteria, fungi, viruses, and other species can be detected in soil, water, and air samples using PCR-based approaches. These techniques are especially valuable for monitoring environmental contaminants and diseases that may endanger human health.

DNA cloning: Polymerase chain reaction is frequently used to amplify DNA sequences for cloning onto vectors for genetic engineering applications. Large amounts of DNA can be generated for cloning using PCR-based technologies, allowing the synthesis of recombinant proteins, gene therapy vectors, and transgenic species. Methods based on polymerase chain reaction can also be utilized to produce mutant DNA sequences for functional research.

Evolutionary studies: PCR-based DNA sequencing technologies are frequently employed in evolutionary studies to compare DNA sequences across species and to reconstruct organisms' evolutionary histories. PCR-based technologies can amplify specific

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DNA sequences from ancient DNA samples, allowing researchers to investigate extinct species and reconstruct evolutionary relationships. To summarize, PCR has transformed DNA sequencing by allowing the amplification and analysis of specific DNA sequences from a wide variety of samples. There are

several uses for PCR-based approaches in genomics research, disease diagnostics, forensic science, environmental monitoring, DNA cloning, and evolutionary studies. New PCR-based methodologies and technologies are projected to broaden the uses of PCR in DNA sequencing and molecular biology.