Scaffolded DNA Synthesis

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ABSTRACT

Together with Researchers at the University of Texas at Austin, researchers at the University of California, Davis have developed a method for synthesizing long polynucleotides using scaffolded cooperative binding and enzymatic ligation to improve yield, modification compatibility, and assembly accuracy.

FULL DESCRIPTION

This DNA assembly method enables the synthesis of long, chemically modified DNA strands using a single-stranded DNA scaffold as a template. Short adapter oligonucleotides hybridize at defined intervals along the scaffold, forming docking sites for DNA fragments that connect adjacent adapters. Each fragment hybridizes with high specificity due to complementary domains that span between two adapters, ensuring that only correctly assembled products remain stable. A ligase then seals the fragments into a continuous DNA strand that replicates the scaffold sequence.

This one-pot, PCR-free process maintains all original chemical modifications, including methylation, fluorescent labels, and biotin. It also prevents misalignment of repetitive sequences and avoids intermediate fragment accumulation. By optimizing oligo ratios, the process yields high concentrations of full-length products in a single step. This approach offers improved fidelity, efficiency, and compatibility with complex sequence designs compared to conventional methods.

APPLICATIONS

- Gene editing and synthetic biology.
- DNA-based data storage.
- Epigenetic research.
- Personalized vaccine development.
- Molecular diagnostics.

FEATURES/BENEFITS

- Preserves methylation, fluorescent tags, and other chemical modifications.
- Avoids PCR amplification to reduce sequence errors.
- Produces high-yield, full-length DNA in a single reaction.
- Maintains alignment across repetitive or homologous regions.
- Streamlined, scalable workflow compatible with automation.
- Solves key challenges in high-fidelity DNA synthesis for modified sequences.
- Valuable for research tools, therapeutics, and data storage solutions.
- Seamlessly integrates with commercial oligo manufacturing platforms.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

adapted oligonucleotides, cooperative binding, DNA ligase, long nucleic acid synthesis, methylated nucleotides, polynucleotide scaffold, self-assembly, sequence specificity, synthetic biology, target strand assembly

CATEGORIZED AS

- **Biotechnology**
  - Genomics
- **Research Tools**
  - Nucleic Acids/DNA/RNA

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