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Programmable Recombinases for Next-Generation Genome Engineering

Researchers at Stanford have developed a platform to design and screen novel chimeric large serine recombinases (LSRs), enzymes capable of inserting large DNA payloads into precise locations in the genome.

Delivering large pieces of genetic material to specific genomic locations remains a key bottleneck in gene therapy and bioengineering. Existing tools are either imprecise or difficult to retarget for new genomic sites. Native LSRs offer specificity but are hard to reprogram and often perform poorly in human cells.

This platform enables rapid, combinatorial screening of engineered LSRs built by mixing and matching functional components from different naturally occurring enzymes. The result is a diverse library of new recombinases, including one standout variant with notably high activity in human cells. This platform opens new possibilities for therapeutic gene delivery and broader genome engineering applications.

Stage of Development : Proof of concept

Applications

- Gene and cell therapy (targeted DNA integration)
- Synthetic biology and genome engineering tool development
- Plant and agricultural biotechnology (crop engineering)

Advantages

- High-throughput screening replaces slow, one-at-a-time engineering approaches
- Identified variants with higher activity in human cells than native LSRs
- Potentially simpler and more precise than multi-component editing systems

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