Technology Offer

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Species-Independent Gene Integration: CRISPRpad

Universal genomic landing pads for site-directed nucleases

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Background

Advances in genome editing, particularly through the CRISPR/Cas9 system, have opened new possibilities for research, biotechnology, and medicine. However, realizing the full potential of these tools remains challenging, as effective gene insertion often requires species-specific adaptations. Each organism presents unique genomic contexts, making it difficult to apply a single editing strategy across multiple species. Current approaches frequently demand customized integration sites and tailored gene constructs to ensure stable expression without unexpected side effects. This complex, extensive workload process slows the transfer of genetic constructs between various species. To address these limitations, researchers seek a universal method for precise, predictable nucleic acid integration that reduces off-target effects and can be applied across diverse organisms.

Technology

Scientists from the Max Planck Unit for the Science of Pathogens have developed the CRISPRpad to overcome genome editing limitations. This technology introduces synthetic, orthogonal "landing pads" for gene integration. Constructed from underrepresented sequences in reference genomes, these pads enable precise and species-independent gene insertion. By minimizing overlap with host genomes, CRISPRpads reduce off-target effects and simplify the editing process. Each pad consists of sequence fragments forming synthetic protospacers, carefully constructed to be absent in target genomes. This universal platform supports consistent, predictable multi gene insertion and control across diverse organisms, including yeast, bacteria, and mammalian cells, enabling transformative applications in biotechnology and therapeutic development.

The key advantages of this method include:

- Universal compatibility: Designed for reliable application across multiple species, from microbes to mammalian cells.
- No detectable off-target effects: Uses unique, underrepresented sequences, ensuring high specificity with CRISPR/Cas systems.
- Streamlined workflows: Avoids repetitive design work for individual species.
- Broad applicability: Suitable for diverse fields, including synthetic biology i.e., dCas driven gene expression, gene therapy, and agricultural biotechnology.

Patent Information

Patent Application PCT/EP2024/081395, filed on 6th of November 2024

Opportunity

We welcome **research partnerships** and **license agreements** to advance the CRISPRpad platform toward commercialization