DREXEL UNIVERSITY
School of Biomedical Engineering, Science and Health Systems

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Integration of AI-Generated CRISPR/Cas-9 Into HIV-Targeting Model

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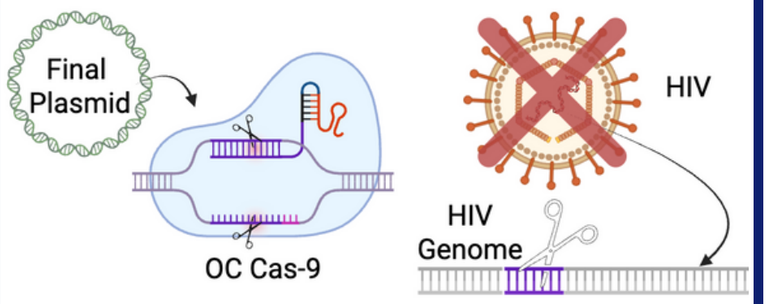
Map Demo

NEED

HIV attacks the body's immune system, resulting in **630,000 deaths** in 2023 [1], **not curable** by current treatment options [2].

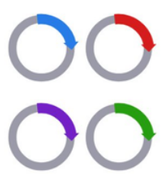


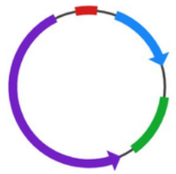
Potential Cure: OpenCRISPR [3], an AI-generated **CRISPR-Cas9**, modular plasmid system used to modify viral genome

Objective: Create a **modular MuLE** plasmid using **OpenCRISPR (OC)** to target and inactivate **HIV**

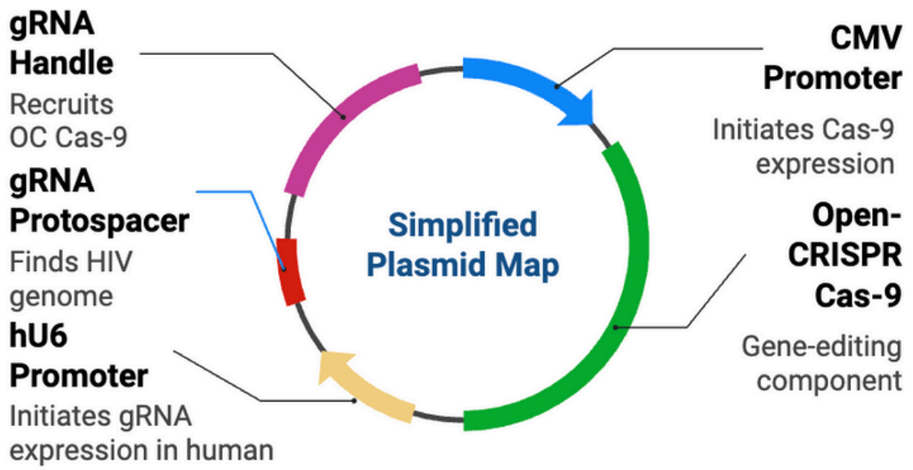
SOLUTION

Modules: Inter-changeable units with intended function





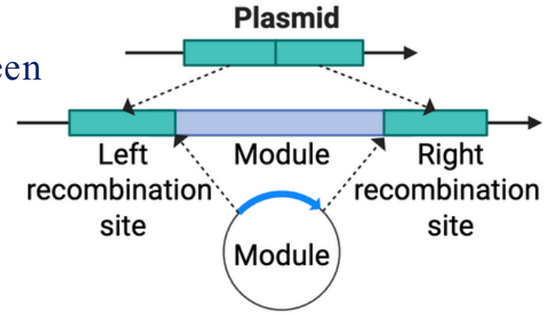
Modular Plasmid: Contains all components to cut HIV genome



DESIGN INPUTS

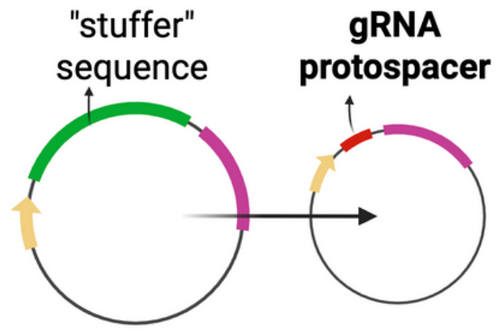
Key Constraints:

- Modules between **Left and Right** recombination sites
- Gene-editing tool using **OC**



Key Requirements:

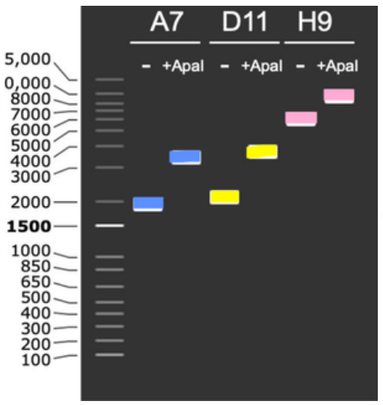
- **R1:** Key Plasmid **Modular Order** (see Solution)
- **R2:** Replace "stuffer" by **HIV protospacer**



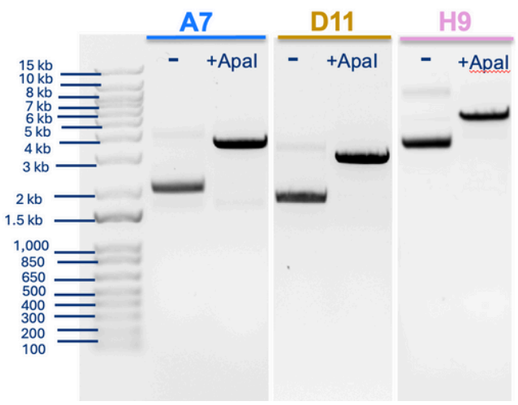
VERIFICATION & RESULTS

V1: Gel Electrophoresis (R1, R2): Verify **presence** and **size of modules** by fragment band sizes (True/False)

Simulated gel



Experimental gels



V2: Sanger Sequencing (R1, R2): Verify **plasmid construction** by comparing with known sequences (**≥99%** match)

Known sequence of CMV promoter

GGCAGTACATCAATGGGCGTGGATAGC

GGCAGTACATCAATGGGCGTGGATAGC

Obtained sequence of CMV promoter

Overall Results

Test	Pass	Fail
V1	100%	0%
V2	89%	11%

FUTURE & CONCLUSION

- Finalize all project SOPs
- Integrate OC Cas-9 and gRNA handle into plasmid
- **Validation of functionality:** Reduced Expression Screening in HIV co-expressed with Green Fluorescence Protein cells

For Users:

- Lowers dependence on expensive, patented systems

For Affected Populations:

- Expands access to affordable yet effective treatments to reduce the HIV/AIDS burden

Acknowledgements

- *Dr. William Dampier, Rachel Berman, Department of Microbiology and Immunology*
- *Drexel University School of Biomedical Engineering, Science and Health Systems*

Reference

1. *https://www.unaids.org/en/resources/fact-sheet*
2. *https://clinicalinfo.hiv.gov/en/glossary/viral-rebound*
3. *https://pubmed.ncbi.nlm.nih.gov/11285236/*

Glossary

- HIV: human immunodeficiency virus
- AI: Artificial Intelligence
- CRISPR: clustered regularly interspaced short palindromic repeats
- CRISPR-Cas9: gene-editing technology
- MuLE: Multiple Lentiviral Expression
- SOP: standard operating procedure