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CRISPR-CAS13-BASED APPROACH FOR THE TREATMENT OF VIRAL DISEASES CAUSED BY RNA VIRUSES

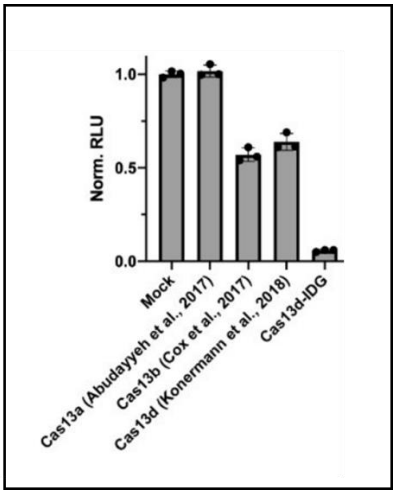
Keywords: CRISPR, Cas13, anti-viral, RNA virus, SARS-CoV-2

INVENTION NOVELTY

A proprietary CRISPR/Cas13 system has been developed (Cas13IDG) for the treatment of viral diseases caused by RNA viruses, such as SARS-CoV-2. The approach has been optimized for high cytosolic Cas13 protein levels and an increased enzyme activity for efficient binding and degradation of viral or bacterial RNA, which is mainly replicated in the cytosol.

VALUE PROPOSITION

Despite current attempts of developing vaccines against human-pathogenic viruses, there is still a high demand to provide alternative or improved methods and therapeutic agents for treatment and/or prevention of diseases caused by human-pathogenic RNA viruses. CRISPR/Cas13 directly targets ribonucleic acid sequences instead of the tertiary structure of proteins and can be used as an antiviral/antibacterial therapy that directly attacks pathogenic RNA molecules. Such approaches are modular and adaptable by using the pathogenic genome as a target, which offers a much easier and faster access to tailored therapeutics than addressing the tertiary structure of proteins.



Comparison of RNA-degradation efficiencies of Cas13 systems [Source: unpublished manuscript]

TECHNOLOGY DESCRIPTION

Cas13IDG has been designed for optimized activity in the cytosol of virus infected cells. Compared to published Cas13 proteins, CAS13IDG shows an improved enzymatic degradation efficiency (Fig). About 80% reduction in virus load was demonstrated in SARS-CoV-2 infected cells. It has been shown that multiplexing is possible by simultaneous application of different gRNAs addressing several areas of the viral genome in parallel, ensuring efficient and sustainable degradation.
The highly efficient Cas13IDG could be broadly used for the development of therapeutic strategies against RNA viruses (e.g., influenza A, Ebola, measles, hepatitis C, TBE, dengue fever, yellow fever, Zika fever), adapting system by variation of tailored guide RNA (gRNA) sequences for the respective viral genome.

COMMERCIAL OPPORTUNITY

The technology is available for licensing or further co-development.

DEVELOPMENT STATUS

Current activities are directed towards nanoparticle-based delivery of the Cas13IDG system to the lung in a mouse-adapted SARS-CoV-2 model.

PATENT SITUATION

A priority establishing LU patent application was filed in December 2020 entitled "*Application of CRISPR/Cas13 for therapy of RNA virus and/or bacterium induced diseases*" followed by a PCT application (WO2022/136370A1).

FURTHER READING

Manuscript is under review.

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