Scientific Essay about

Genetic Engineering Will Change Everything Forever – CRISPR

[Supplementary Essay 3]

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Abstract

The maintain of genome integrity is most important thing in all life but some failure can make mutation or exogenous, endogenous factors threat stability. Bacterial also was faced on infecting by phage but this life not only destroyed the phage DNA and save fragments of the DNA its genome. It can be useful to recognition and fast response for re-infecting by same phage. Scientist using this pathway to genome editing.

Summary

This video clip show history of discovery of CRISPR-cas9 genome editing system. I found original paper of how to find CRISPR so I introduce the history of CRISPR-cas9 system.

First discovery of this system in bacterial is at 1987. A Japanese scientist found free sequence on some gene. In this period, they did not know what is the function of this sequence. Their conclusion is just it looks like stem-loop structure but don't know about function. After several years, other group also found that several bacterial have similar sequences repeat contain on their genome. So they provide named 'clustered regularly interspaced short palindromic repeats' and some protein located near by the sequence in several bacterial. Therefore, they named shortly "Cas" protein.

When a microbe is invaded by a virus, the first stage of the immune response is to capture viral DNA and insert it into a CRISPR locus in the form of a spacer. Cas1 and Cas2 are found in all three types of CRISPR-Cas immune systems, which indicates that they are involved in spacer acquisition. Mutation studies confirmed this hypothesis, showing that removal of cas1 or cas2 stopped spacer acquisition, without affecting CRISPR immune response.

CRISPR/Cas9 genome editing is carried out with a Type II CRISPR system. When utilized for genome editing, this system includes Cas9, CRISPR RNA (crRNA), trans-activating crRNA (tracrRNA) along with an optional section of DNA repair template that is utilized in either Non-Homologous End Joining (NHEJ) or Homology Directed Repair (HDR).

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CRISPR/Cas9 often employs a plasmid to transfect the target cells. The main components of this plasmid are displayed in the image and listed in the table. The crRNA needs to be designed for each application as this is the sequence that Cas9 uses to identify and directly bind to the cell's DNA. The crRNA must bind only where editing is desired. The repair template is designed for each application, as it must overlap with the sequences on either side of the cut and code for the insertion sequence.

Reference

1. CRISPR Provides Acquired Resistance Against Viruses in Prokaryotes (Science. R. Barrangou. 2007)
2. Nucleotide sequence of the iap gene, responsible for alkaline phosphatase isozyme conversion in Escherichia coli, and identification of the gene product (J.Bacteriol. Y Ishino. 1987)
3. Identification of genes that are associated with DNA repeats in prokaryotes (Mol Microbiol. R.Jansen, 2002)
4. https://www.youtube.com/watch?v=jAhjPd4uNFY&feature=youtu.be&noredirect=1
5. https://en.wikipedia.org/wiki/CRISPR