Genome-wide CRISPR Screens

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What are ways to interfere gene expression?

What are ways to interfere gene expression?

KNOCKOUT vs. KNOCKDOWN





Two major ways to interfere gene expression



RNA interference

Two major ways to interfere gene expression



RNA interference

ZFN/TALEN (protein-based)

What is gene editing?



Gene editing is a technique that enables precise **changes** to be made in the organism's **DNA sequences.**

Why do we need gene editing?



Decode function of genes

AGGAAG THE GA G GG MUTATION CG GIGAATTG ATT



Correct mutations to cure disease

What is **CRISPR**?

Clustered Regularly Interspaced Short Palindromic Repeats



The CRISPR/Cas9 system offers an RNA-guided mechanism for introducing precise mutations at a target locus

How does the CRISPR/Cas9 system work?



How does the CRISPR/Cas9 system work?



Who discovered CRISPR?

Oct. 2020, Jennifer Doudna and Emmanuelle Charpentier receive Nobel Prize for discovery of CRISPR/Cas 9.

Pros vs Cons of CRISPR



- efficient
- ✓ wider range of target
- ✓ affordable
- Iess off-target effect

Pros vs Cons of CRISPR



Iess off-target effect

X required PAM
X permanent editing
X unethical

Cons

Why is CRISPR a revolution?



Faster
Efficient & accurate
affordable

Any other applications of CRISPR/Cas9?





What are genetic screens?



Genetic screens are techniques to determine genes responsible for certain phenotypes.

Two types of screening

Forward screening:



Two types of screening

Forward screening:



Reverse screening:



How does genome-wide screen work with CRISPR?



Two types of CRISPR screen



Two types of CRISPR screen



CRISPR/Cas9 Summary

Two major ways to interfere gene expression



Multiple ways to interfere gene expression

How does the CRISPR/Cas9 system work?



CRISPR/Cas9 is an **RNA-guided** gene editing tool introduce **precise modification** to DNA



CRISPR is used for **genome-wide** screens to analyze gene functions

How have CRISPR screens been used to understand SARS-CoV-2?

Check for updates

ARTICLE

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OPEN

A genome-wide CRISPR screen identifies host factors that regulate SARS-CoV-2 entry

Yunkai Zhu^{1,6}, Fei Feng^{1,6}, Gaowei Hu^{1,6}, Yuyan Wang^{1,6}, Yin Yu¹, Yuanfei Zhu¹, Wei Xu¹, Xia Cai¹, Zhiping Sun¹, Wendong Han¹, Rong Ye¹, Di Qu¹, Qiang Ding ⁰², Xinxin Huang³, Hongjun Chen⁴, Wei Xu⁵, Youhua Xie ¹, Qiliang Cai ^{1™}, Zhenghong Yuan ^{1™} & Rong Zhang ^{1™}

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What is SARS-COV-2 and how does it infect the cell?



About the Scientists



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Question?