

CRISPR/Cas9

Synthetic Biology Module 4
University of Rochester iGEM 2020

Checklist for Module #4

- Read linked articles from syllabus
 - Questions and answers about CRISPR
- Open Google Form #4

Module Overview

- What is CRISPR/Cas9?
- History of CRISPR/Cas9
- What is guide RNA, Cas9 enzyme?
- How is CRISPR/Cas9 delivered?



What is Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR/Cas9?)

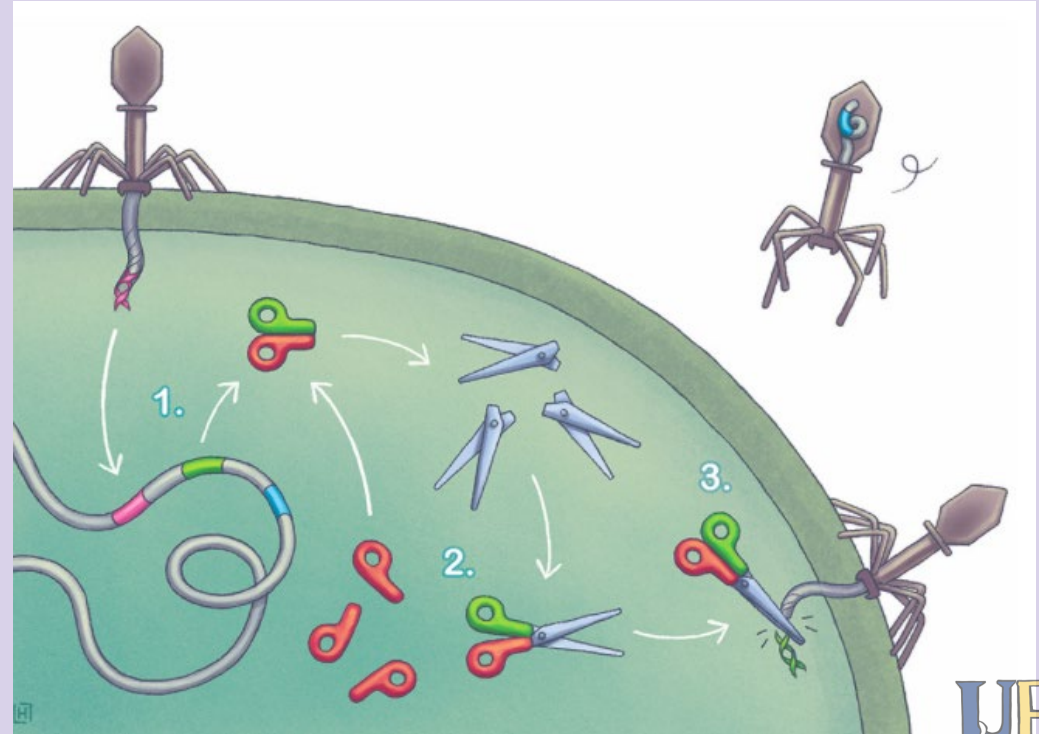
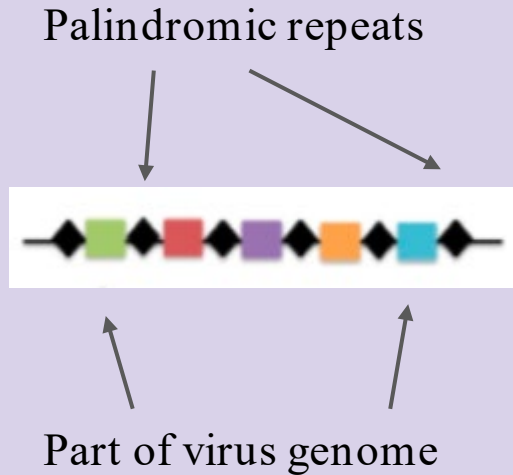


An amazing gene editing tool!

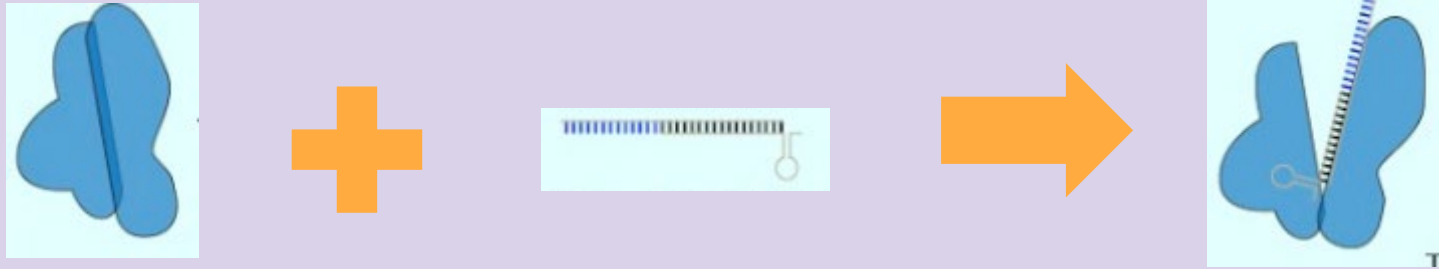


Where is CRISPR/Cas9 originated?

A defense mechanism
adapted from the bacteria!



Two important components in CRISPR/Cas9



- Cas9 enzyme
 - Molecular scissors to cut the target DNA
 - Non-active
- Guide RNA
 - Contain sequences that are complementary to the target DNA
- Cas9/gRNA complex
 - Now active!

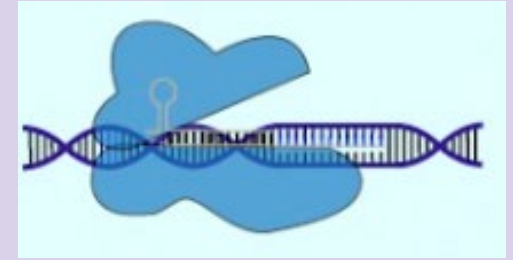
How does CRISPR/Cas9 work?



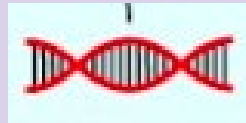
CRISPR/Cas9 complex



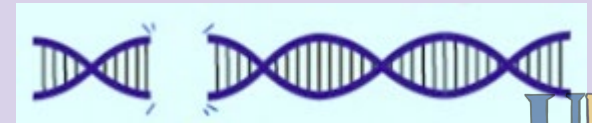
Targeted gene



Final product: original DNA and inserted DNA

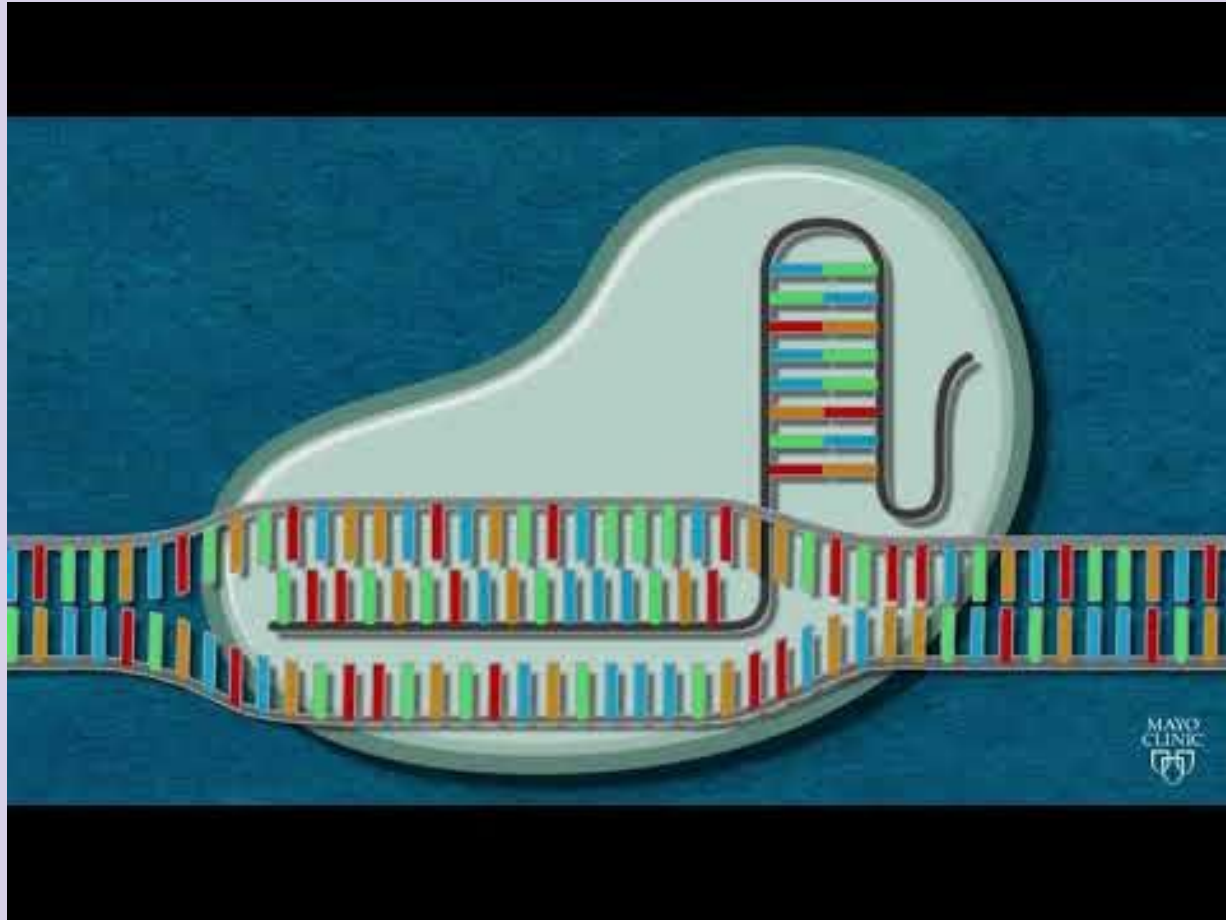


Functional DNA



"broken" genomic DNA

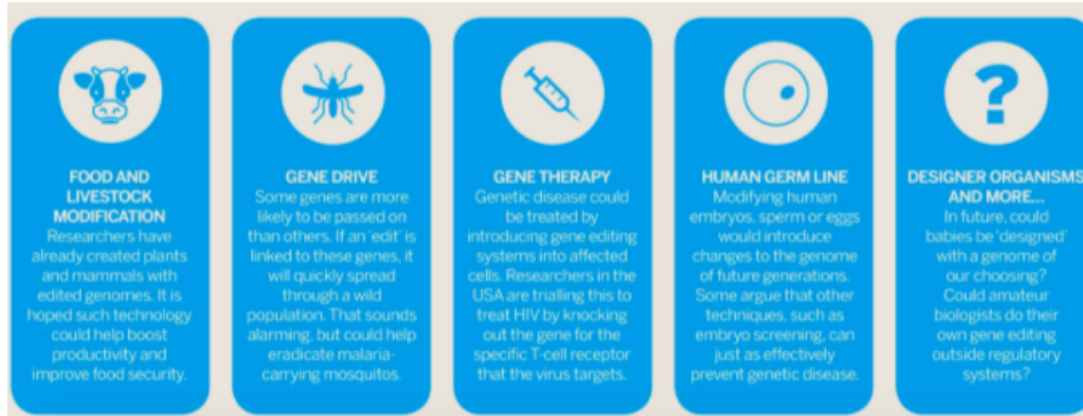




Video: <https://www.youtube.com/watch?v=UKbrwPL3wXE>



1) If you are now a well-known scientist and have access to a fabulous lab, what do you want to research and achieve using CRISPR/Cas9 technique? Picture below with some potential use of CRISPR/Cas9 might give you some inspiration! *



Short answer text

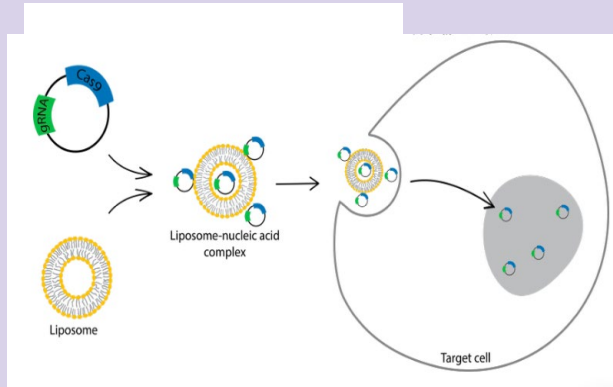
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2) Why do you think CRISPR/Cas9 is helpful in synthetic biology? *

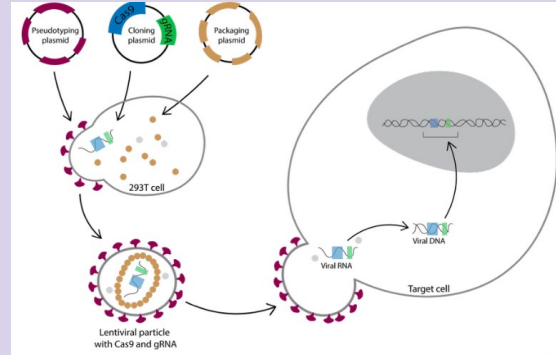
Short answer text

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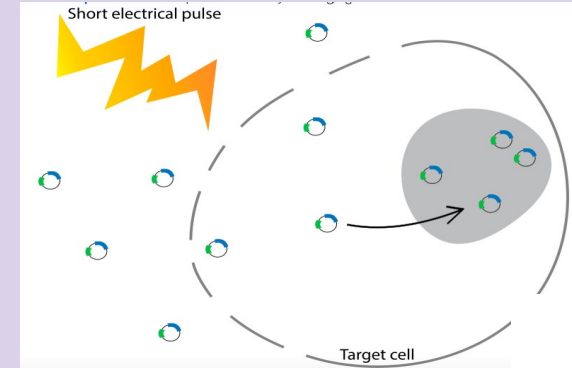
How is CRISPR/Cas9 delivered to the cell?



Lipofection



Lentiviral transduction



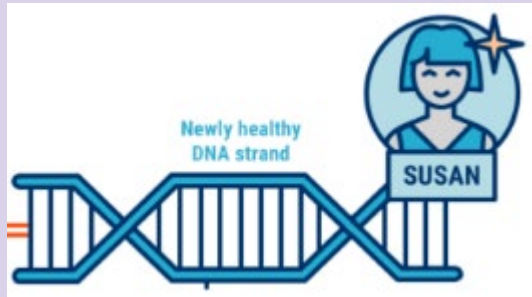
Electroporation

Module Review

- CRISPR/Cas9 is a revolutionary genetic editing technique
- CRISPR/Cas9 is adapted from bacterial defense mechanism
- Guide RNA and Cas9 enzyme
- Mechanism of CRISPR/Cas9
- 3 CRISPR/Cas9 delivery methods



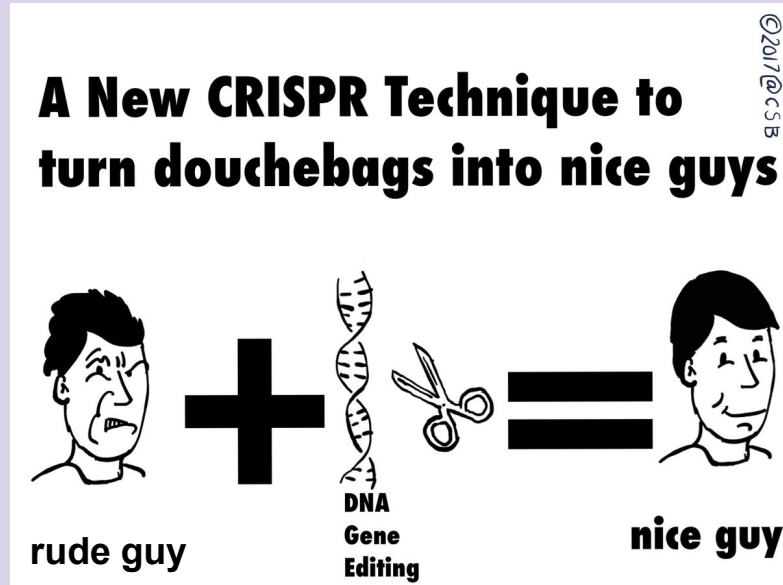
Activity #1



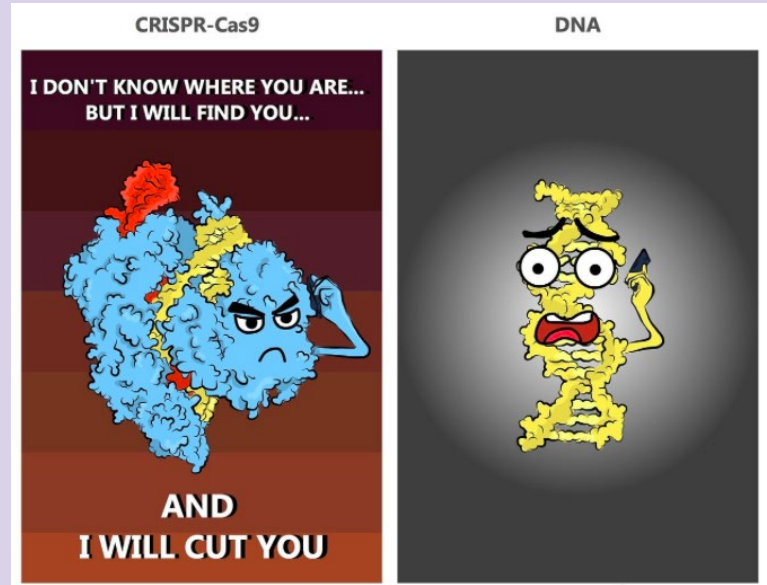
Susan has sickle cell disease which is a genetic disorder that is caused by a single DNA letter mutation. Could you draw the gene-editing process using CRISPR/Cas9 that will help Susan correct the genome?

Activity #2 - Explain CRISPR meme game!

1.



2.



Thank you!

Email us at uofr.igem@gmail.com



Source:

Biolegend. "Biolegend." *BioLegend* 18 Dec. 2017, biolegend.tumblr.com/post/168683162259/take-crispr-chronicles-comic-at.

e-mojo · Multimedia- und Webentwicklung, www.emojo.de. "CRISPR/Cas9: the Double-Edged Sword of Molecular Biology." *Global Biotech Revolution*, globalbiotechrevolution.com/blog/posts/crispr-cas9/.

"Focus on: Gene Editing." *RSB*, www.rsb.org.uk/biologist/158/biologist/features/144-focus-on-gene-editing.

Harvey, Paul, et al. "CRISPR: A Game-Changing Genetic Engineering Technique." *Science in the News*, 31 July 2014, sitn.hms.harvard.edu/flash/2014/crispr-game-changing-genetic-engineering-technique/.

"How to Express CRISPR in Your Target Cells." *Benchling*, 18 Mar. 2020, www.benchling.com/2016/03/24/how-express-crispr-in-your-target-cells/.

"On Crispr-Cas9." *Max Planck Unit for the Science of Pathogens*, 10 Dec. 2018, www.emmanuelle-charpentier-lab.org/research/on-crispr-cas9/.

"What Is CRISPR?" *CB Insights Research*, 17 Feb. 2019, www.cbinsights.com/research/what-is-crispr/.

