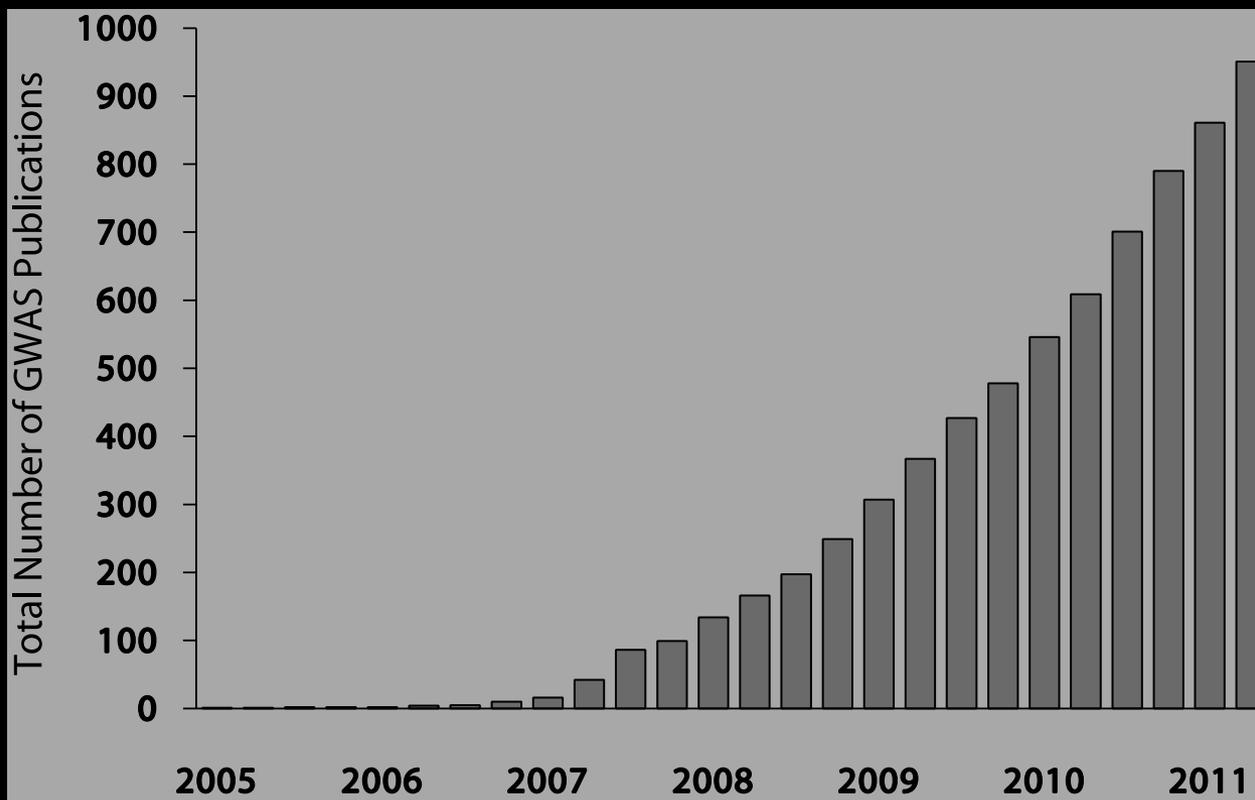


Development and Applications of CRISPR-Cas9 for Genome Editing

Feng Zhang
Broad Institute/MIT
2014.08.13



sickle cell

hemophilia

Parkinson

Alzheimer

**cystic
fibrosis**

Parkinson

**Usher
syndrome**

autism

Huntington

Lafora

**retinitis
pigmentosa**

ALS

genetic mutations underlie many diseases

understanding the complexity of genetic diseases and to develop new treatments require new tools

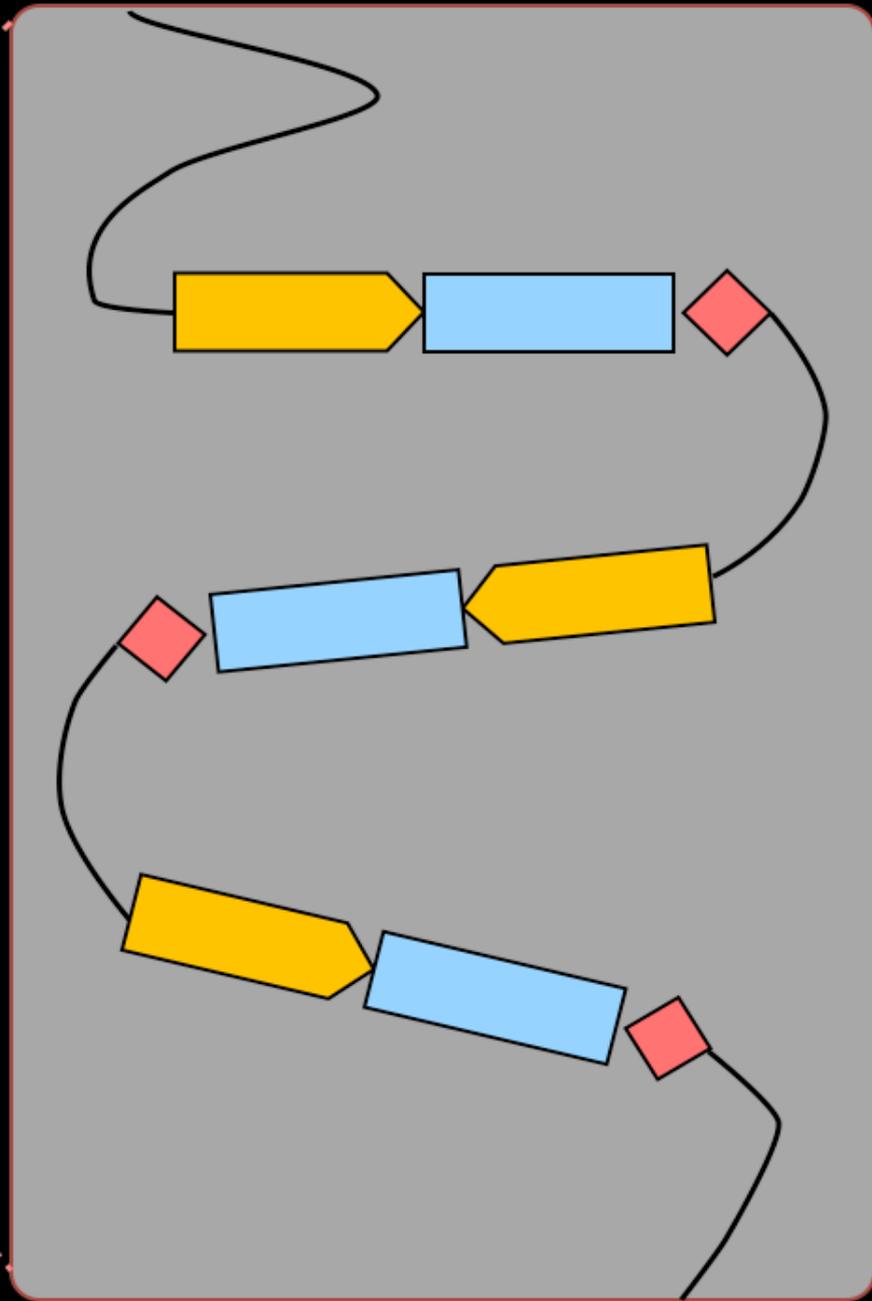
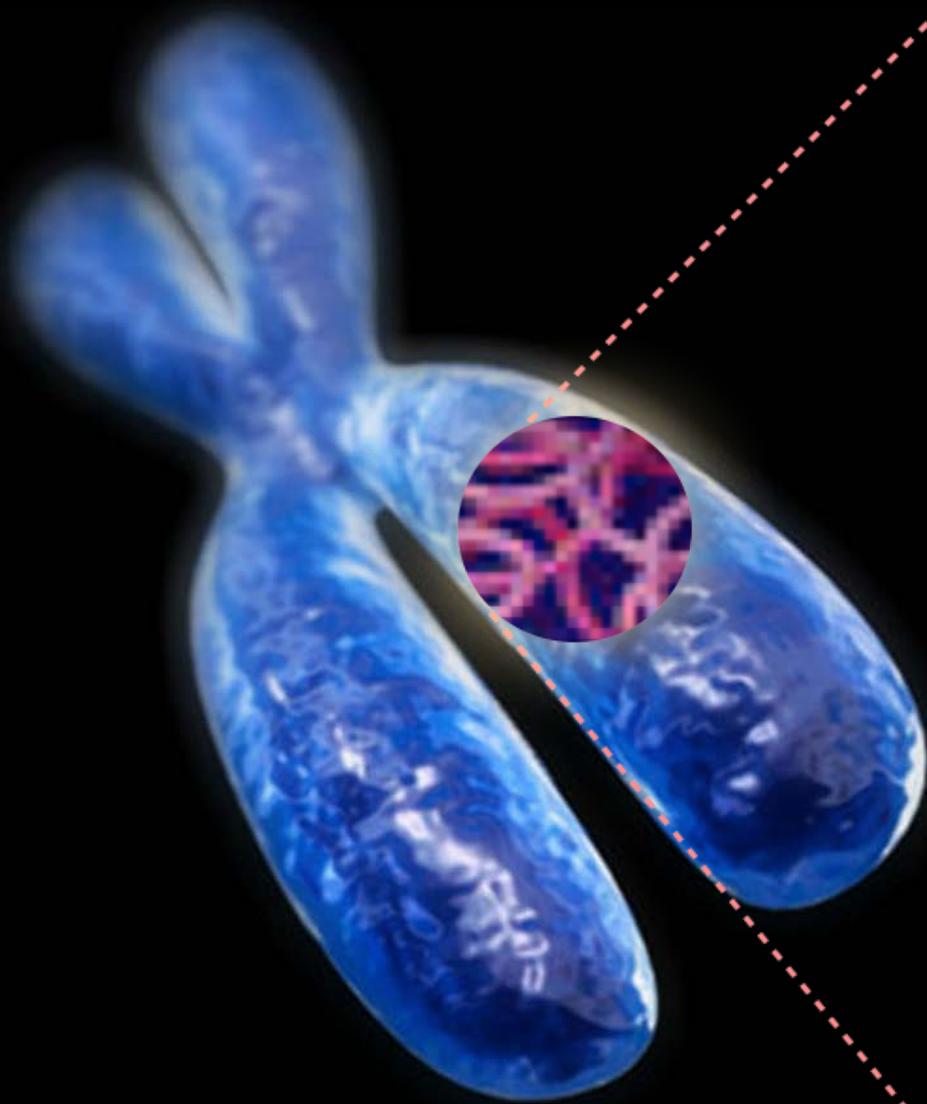
Synthetic Biology: nature inspired engineering







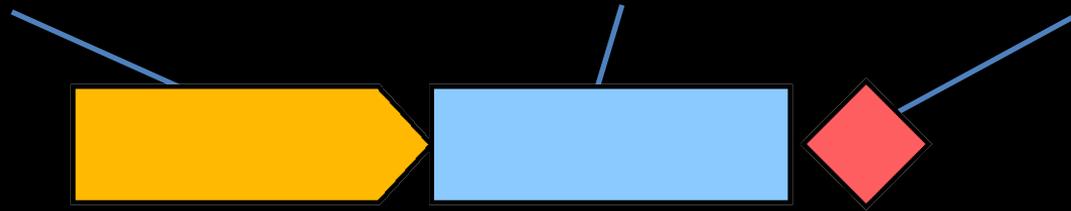
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operator
(verb)

gene
(noun)

terminator
(punctuation)



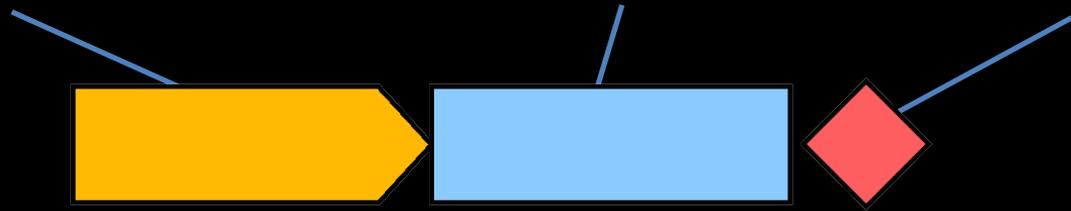
Mutations can result in:

1. Errors in the operator
2. Errors in the gene sequence

operator
(verb)

gene
(noun)

terminator
(punctuation)



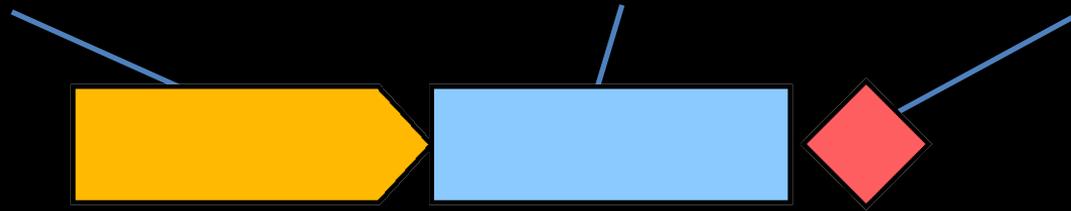
We need to

1. Identify the function of genomic sequences and variations
2. Develop ways to make corrections

operator
(verb)

gene
(noun)

terminator
(punctuation)

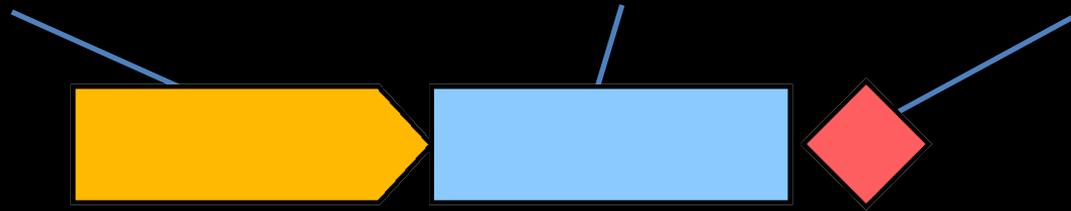


Two roads diverged in a blue wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth; ...

operator
(verb)

gene
(noun)

terminator
(punctuation)

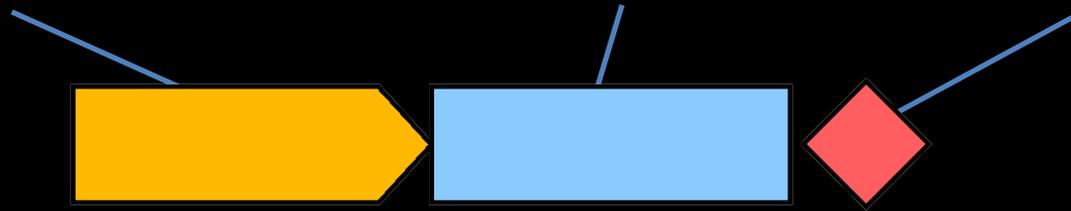


Two roads diverged in a ____ wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth; ...

operator
(verb)

gene
(noun)

terminator
(punctuation)

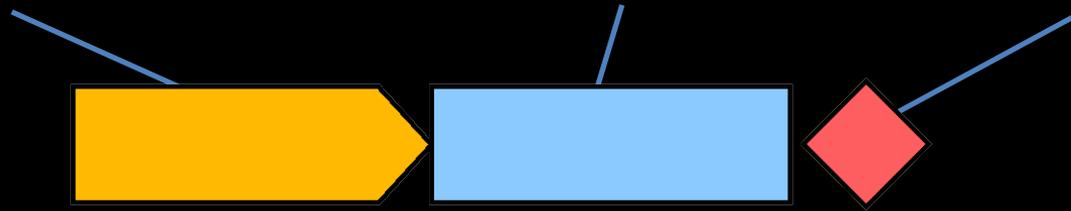


Two roads diverged in a yellow blue wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth; ...

operator
(verb)

gene
(noun)

terminator
(punctuation)



Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth; ...

 Search in Document

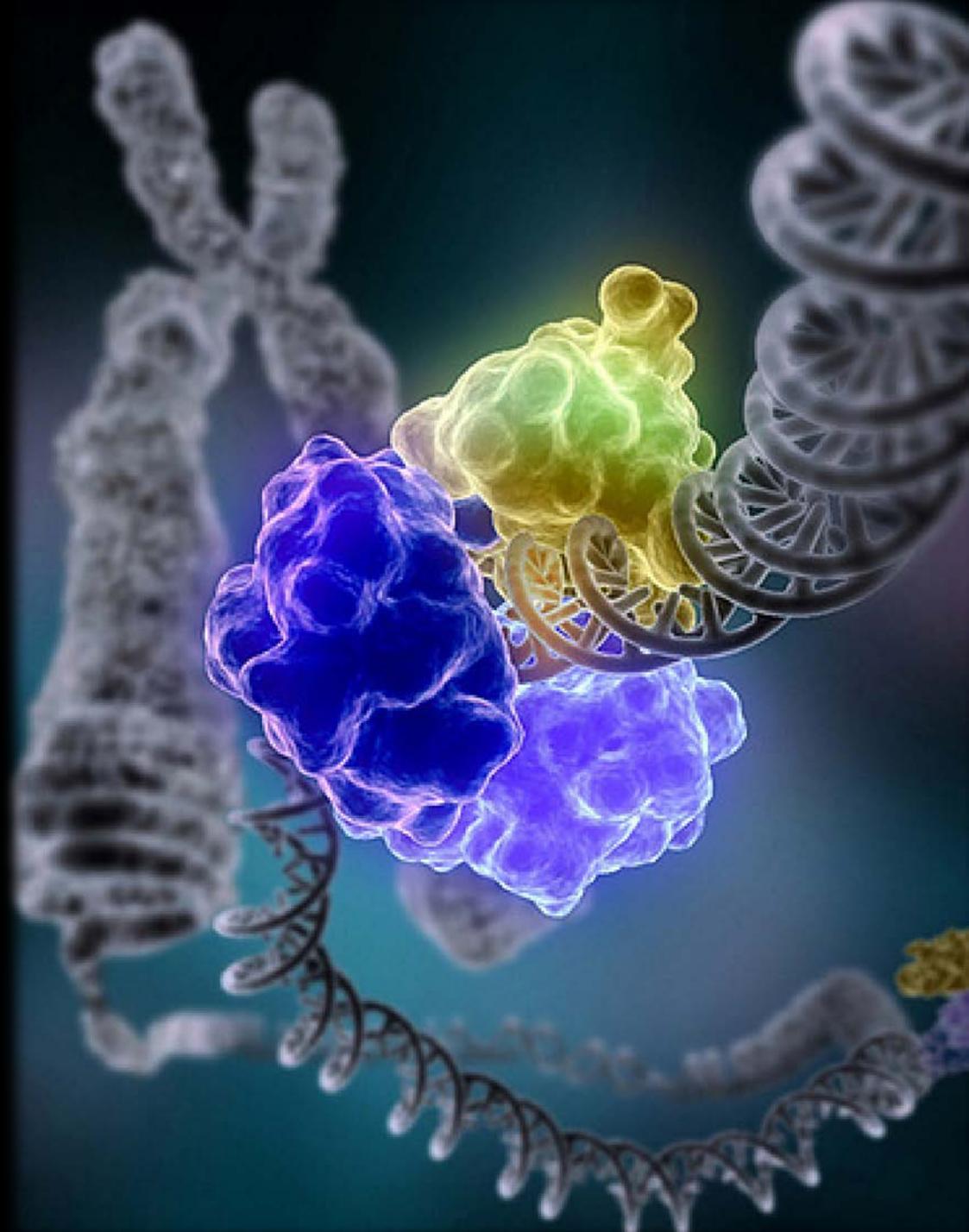


Insert

Themes

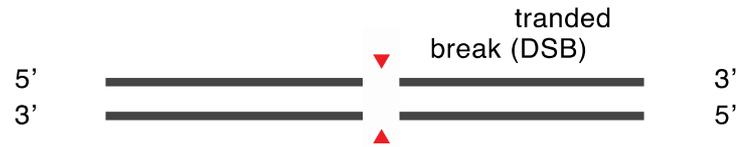


Need to be able
to recognize a
specific location
on the genome.

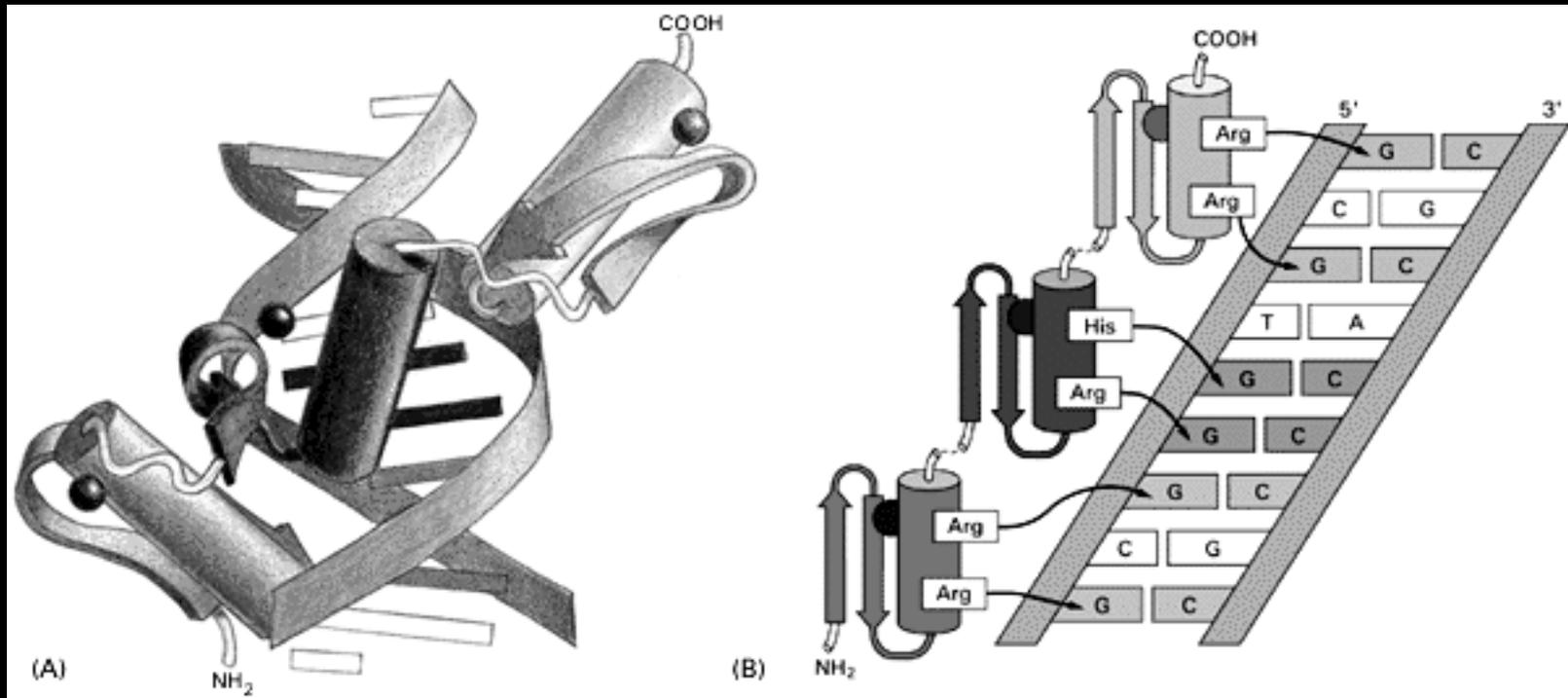




Genome Editing Using Nucleases



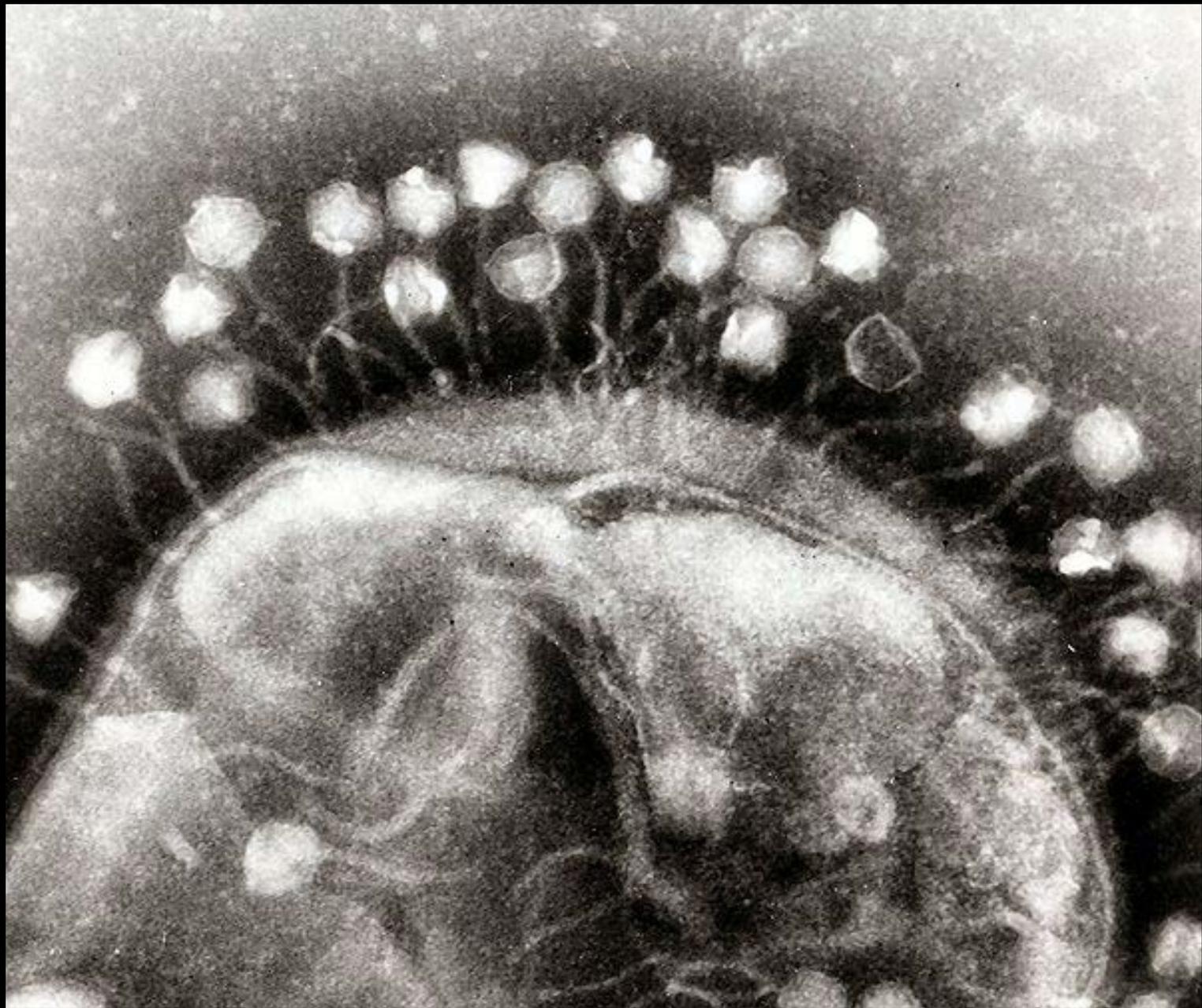
Existing approaches have been very challenging

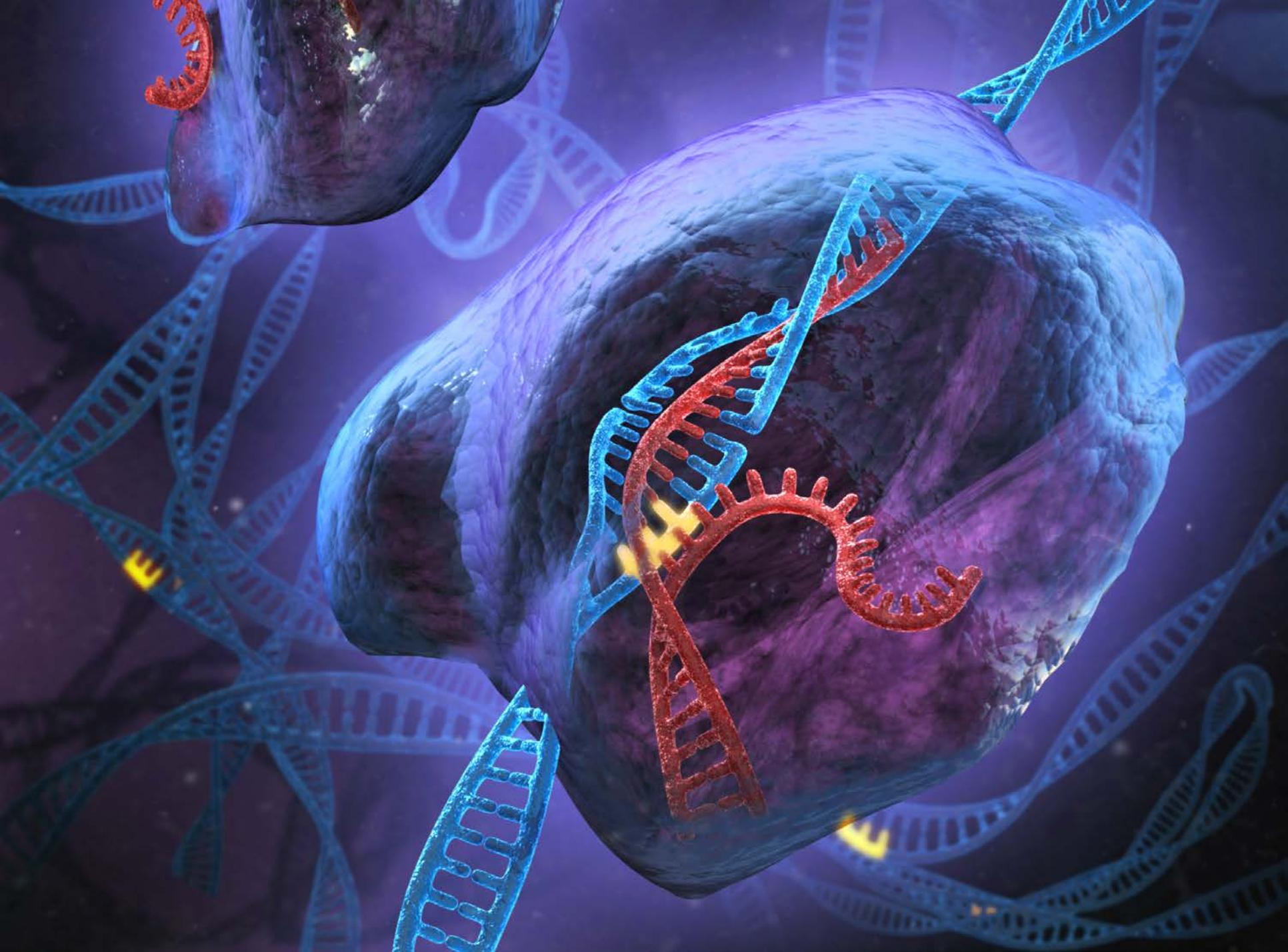


DNA-binding proteins such as “zinc fingers” and “TALEs” are difficult to tailor to recognize new DNA sequences

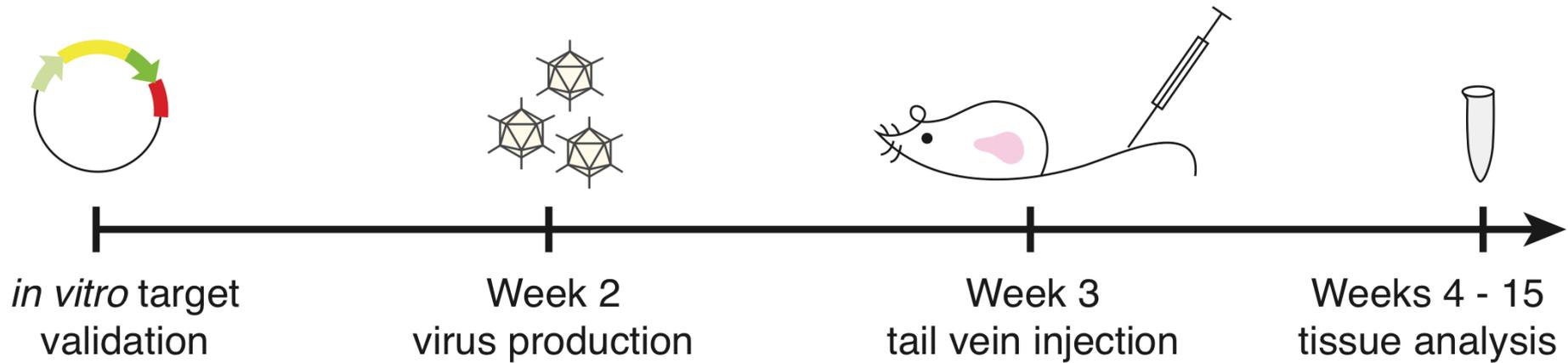
Using yogurt bacteria to
repair genetic mutation



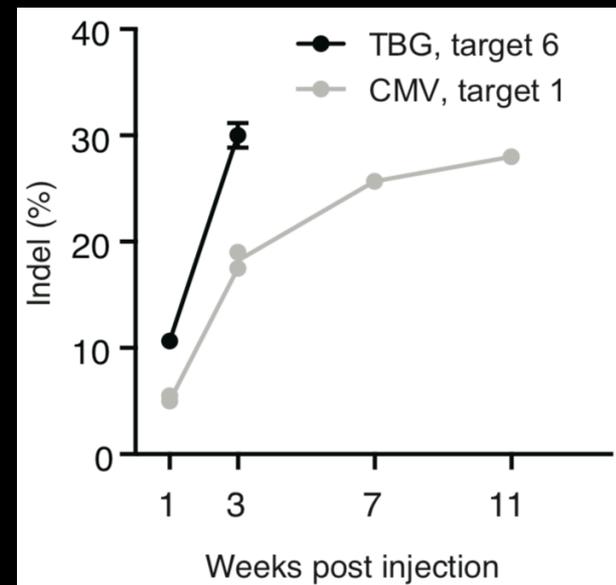




Developing CRISPR into a therapeutic agent

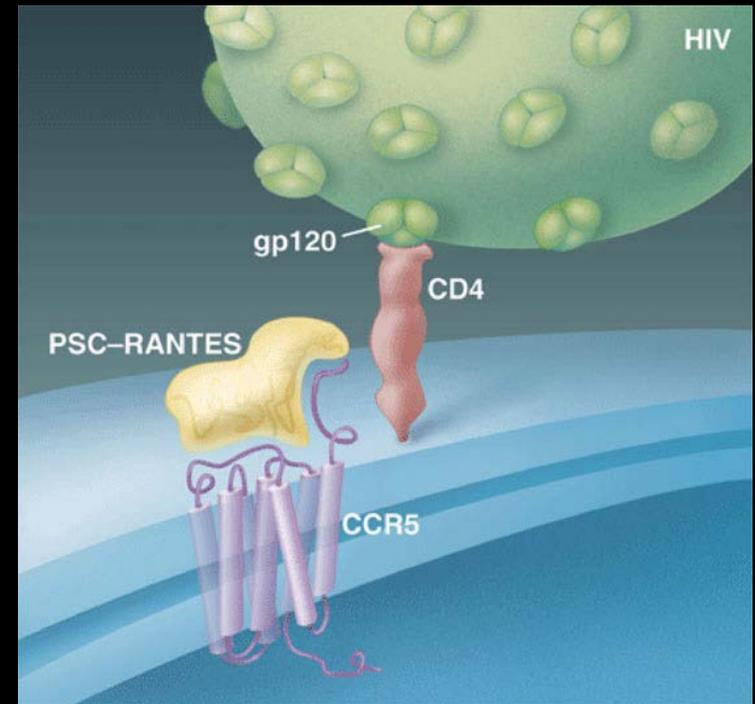
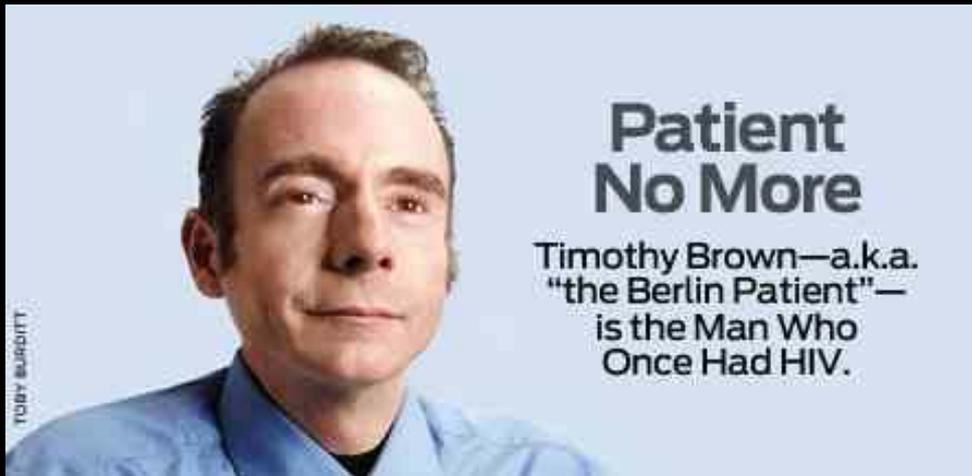


Direct administration to specific disease tissue to mediate therapeutic gene modification.



New Therapies (example HIV)

Introduce protective mutations (e.g. treating HIV by removing the CCR5 gene)



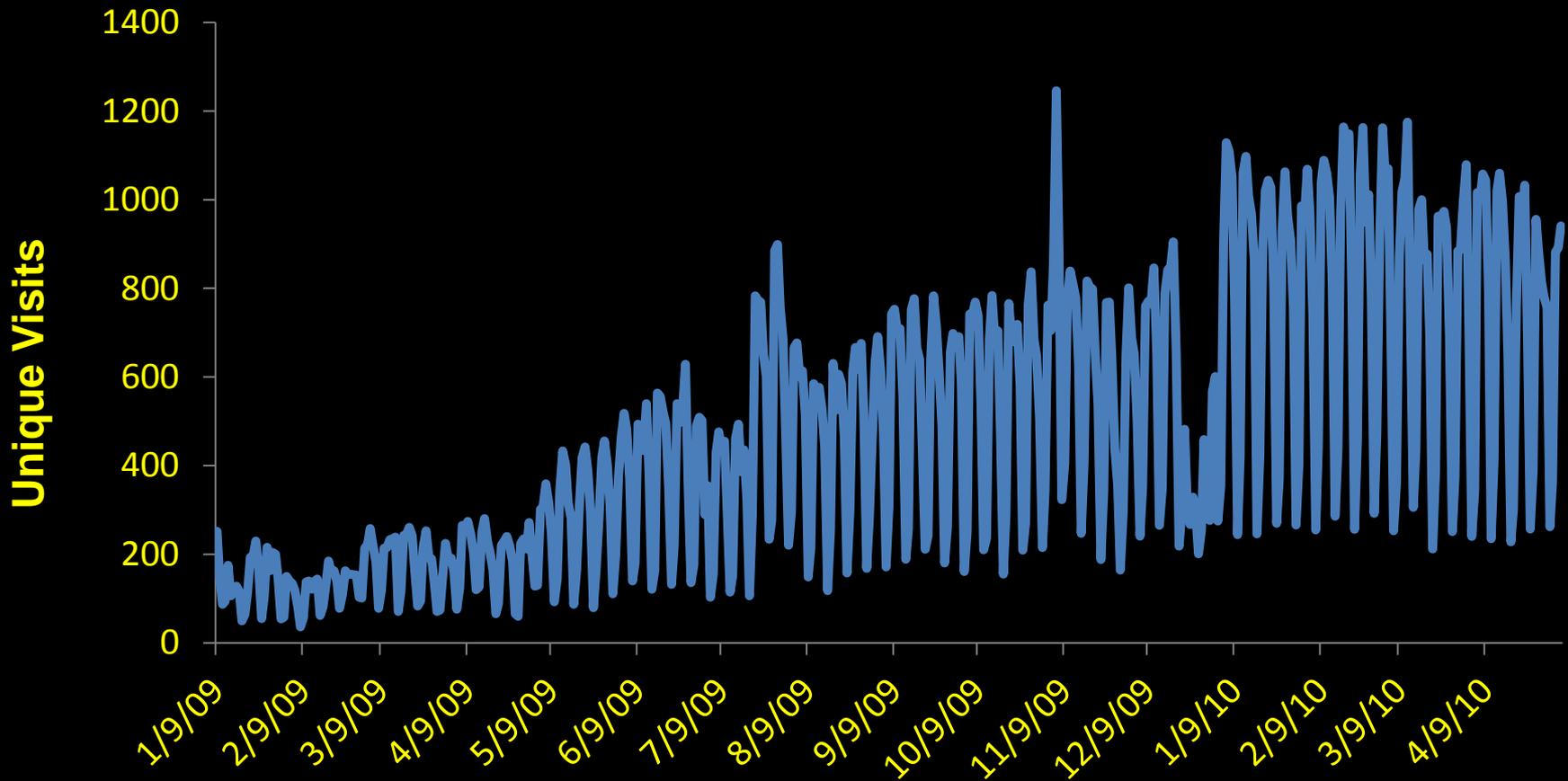
Future Challenges Facing CRISPR as a Therapeutic Technology

CRISPR is still a very new technology

- Development of effective delivery systems
- Careful evaluation of safety, efficacy
- Establishing thoughtful regulations that will enable technological advancement

Genome Engineering RESOURCES

<http://www.genome-engineering.org>



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Ella Hartenian



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zlab.mit.edu