

SI Genetics- Full Discipline Demo

Recombinant DNA, CRISPR, and Genetic Engineering

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Genetics - Full Discipline Demo
Course	SI Genetics- Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match each term with the best description.

Terms to match:

- gRNA
- Genetic engineering
- Recombinant
- Restriction enzymes
- Transgenic

Descriptions to match:

1. Process that uses laboratory technologies to modify the DNA makeup of an organism
2. Organisms containing DNA in their genomes originating from another species
3. Specialized proteins that cut DNA at or near specific locations
4. DNA molecule composed of fragments from more than one source
5. Molecule synthesized in the laboratory to target a specific gene sequence for editing

Correct answers:

- 1 Genetic engineering 2 Transgenic 3 Restriction enzymes
4 Recombinant 5 gRNA

Categorize each statement as true or false.

⚡ Genetically engineered bacteria are used to mass produce insulin.	
⚡ Recombinant plasmids must be cloned using human epithelial cells.	
⚡ The CRISPR-Cas9 system is used to target and cut DNA inside cells of living eukaryotic organisms.	
⚡ Genetically engineered animals are of no benefit to medical research.	
True	False
1	2

Correct answers:

1 Genetically engineered bacteria are used to mass produce insulin.

The CRISPR-Cas9 system is used to target and cut DNA inside cells of living eukaryotic organisms.

2 Recombinant plasmids must be cloned using human epithelial cells.

Genetically engineered animals are of no benefit to medical research.

Exploration

Genetic engineering may involve only deleting a single base pair of genetic code or adding a complete DNA sequence from another organism.

- ☐ True ✓
- ☐ False

Medical applications of genetic engineering technologies include ____.

- ☐ drug manufacturing
- ☐ creation of animal models
- ☐ gene therapy
- ☐ All of the above

✓

Recombinant DNA fragments are joined using ____.

- ☐ restriction enzymes
- ☐ DNA ligase
- ☐ Cas9
- ☐ gRNA

✓

CRISPR techniques involve administering gRNA and the Cas9 enzyme to cells of a living organism.

- ☐ True
- ☐ False

✓

Exercise 1

How did the restriction enzymes and DNA ligase function in the synthesis of recombinant DNA in Part 1 of this exercise?

0 Word(s)

How were the *E. coli* heat shocked in Part 2 of this exercise to allow absorption of the recombinant plasmids?

0 / 10000 Word Limit

What are some medical applications of recombinant DNA in transformed bacteria?

0 / 10000 Word Limit

Photo 1: Recombinant DNA Results
(SAMPLE ANSWER BELOW)

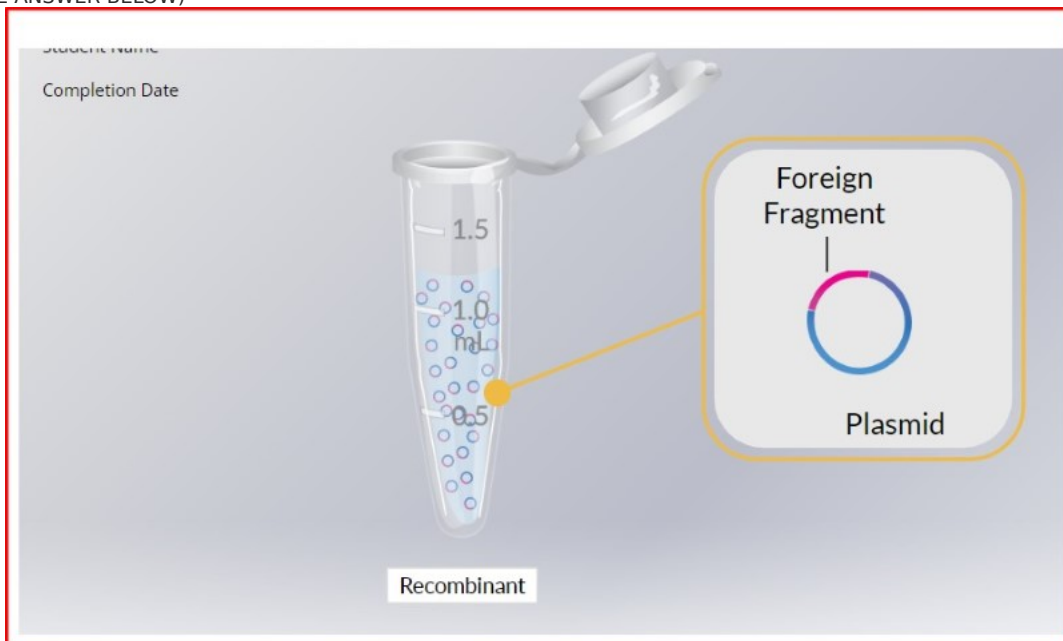
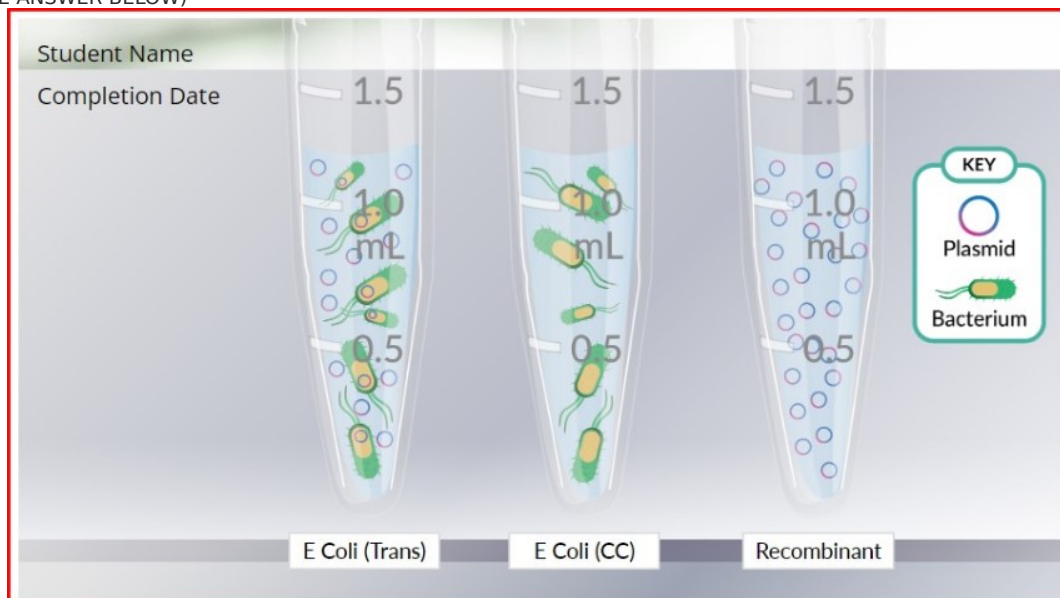


Photo 2: Bacterial Transformation Results
(SAMPLE ANSWER BELOW)



Exercise 2

What are the functions of the DNA oligos and *S. pyogenes* used to create the gRNA in this exercise?

The DNA oligos provide the nucleotides specific to the targeted gene sequence and the bacteria *S. pyogenes* provides a Cas9 scaffold complementary to the target-specific oligos.

How is the gRNA synthesized in this exercise used to edit the DNA of an organism?

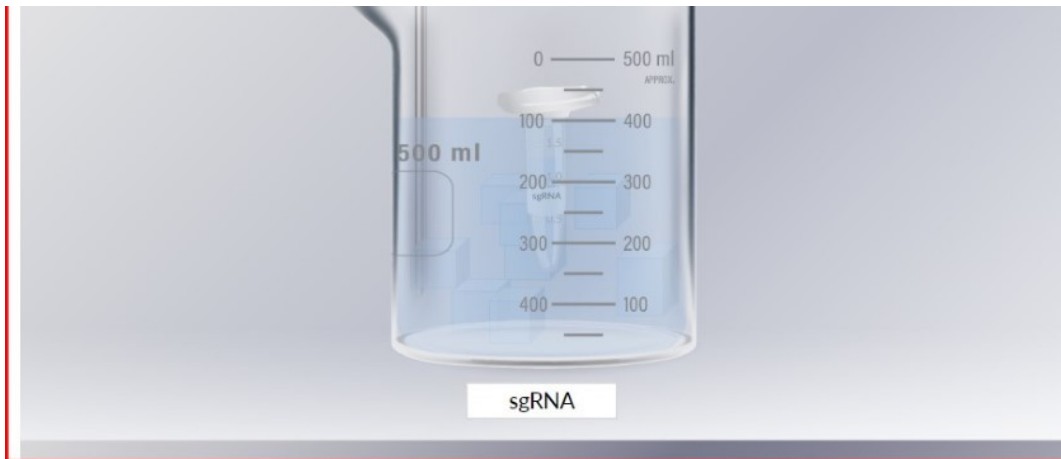
The gRNA and Cas9 enzyme are administered to cells within a living organism. Once inside the cells, the gRNA recognizes the gene sequence of interest and the Cas9 enzyme cuts the DNA at the targeted location. After the DNA is cut, the cell's own mechanisms are utilized to repair the deletion or to insert pieces of a customized DNA sequence that is also administered.

What are some medical applications of CRISPR techniques described in the Exploration of this laboratory?

0 / 10000 Word Limit

Photo 3: CRISPR-Cas9 Results
(SAMPLE ANSWER BELOW)





Competency Review

Genetic engineering is a process that uses laboratory technologies to modify the DNA of organisms.

- ☒ True
- ☐ False



Animals have been genetically modified to ____

- ☐ grow faster
- ☐ produce more nutritious meat
- ☐ resist diseases
- ☒ All of the above

✓

____ is a process used to clone recombinant plasmids.

- ☒ Bacterial transformation
- ☐ Meiosis
- ☐ CRISPR
- ☐ Viral infection

✓

The combination of restriction enzymes and DNA ligase is used to insert genes and other pieces of DNA into plasmids.

- ☒ True
- ☐ False

✓

____ is a genetic engineering technology utilized to selectively modify the DNA inside living organisms.

- ☐ DNA cloning
- ☐ Bacterial transformation
- ☒ CRISPR
- ☐ PCR

✓

CRISPR technology is adapted from genome editing systems found in some bacteria.

☒ True



☐ False

***E. coli* competent cells can be heat shocked during bacterial transformation by moving from an ice bath to a room temperature water bath.**

☐ True

☒ False



_____ is used to synthesize target specific gRNA.

☐ *S. pyogenes*

☐ DNA oligos

☐ DNase

☒ All of the above



Extension Questions

Stan read an internet blog post that consuming GMO foods could alter one's DNA, and now he fears any product associated with genetically modified organisms. Apply your knowledge of genetic engineering to explain to Stan why he should not fear genetically modified foods. (SAMPLE ANSWER BELOW)

Genetic engineering involves techniques for modifying the DNA of organisms. Creating genetically modified organisms requires inserting or deleting nucleotides into their genomes using sophisticated laboratory techniques such as bacterial transformation and CRISPR and cannot be obtained by merely feeding foreign DNA samples to an organism. Furthermore, GMO foods offer many benefits such as increased nutritional value, increased disease resistance, and improved stress tolerance.