

Manipulating and Analyzing DNA

Restriction Enzymes and Recombinant DNA

Introduction:

Today you will examine two extremely important aspects of biotechnology; restriction enzymes and recombinant DNA. You will use two different websites to understand both topics. By the end of today you should be able answer the following questions:

- What are restriction enzymes? How and why are they used in biotechnology?
- How do restriction enzymes play a role in recombinant DNA?

Restriction Enzymes Background:

Biotechnology is the manipulation of the biological capacity of cells and their components. For thousands of years people have used biotechnology by using yeast to make flour into bread and grapes into wine. Today, we are using biotechnology to study the basic processes of life, diagnose illnesses, and develop new treatments for diseases. Biotechnology also provides the means to analyze similarities and differences in DNA between different species (interspecific variation) and between individuals of the same species (intraspecific variation). Since genes and DNA change as a species evolves, interspecific analysis of DNA provides a picture of evolutionary relationships between different species.

Some of the tools of biotechnology are the natural components of cells. Restriction enzymes are made by bacteria to protect themselves from viruses. They inactivate the viral DNA by cutting it in specific places. DNA ligase is an enzyme that exists in all cells and is responsible for joining together strands of DNA. Scientists use restriction enzymes to cut DNA at specific sequences called recognition sites. They then rejoin the cut strands with DNA ligase to make new combinations of genes.

1. From reading the paragraphs above; what is a restriction enzyme? Why are they used?

Restriction Enzyme Activity:

Go to the following website: <http://www.dnalc.org/resources/animations/restriction.html>. Before you start the animation, read the paragraph above the animation box. As you click through the animation, be sure to read everything. These questions are in order.

1. First of all, a restriction enzyme is an enzyme. Enzymes are made of _____ and _____ chemical reactions.
2. Where were restriction enzymes originally found? What did they do?
3. Restriction enzymes are _____, for example EcoR1, binds to _____
4. These sequences are called _____. What does it mean to say that DNA restriction enzymes produce “sticky ends?” Explain.
5. What does DNA ligase do? Explain.

Recombinant DNA Background:

Scientists use restriction enzymes to create recombinant DNA. Recombinant DNA sequences typically contain genes (composed of DNA) from two or more organisms. Recombinant DNA can be inserted into plants, animals, or bacteria in order to create transgenic species, or species that express foreign DNA. For example, the human insulin gene can be inserted into bacteria, which will then produce human insulin.

1. From the paragraph above; why do scientists create recombinant DNA?

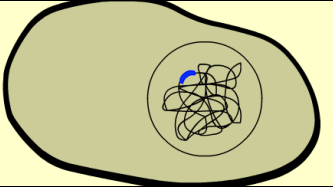
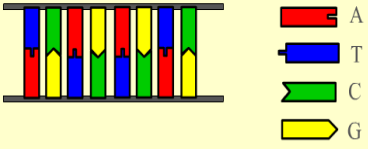
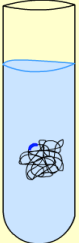
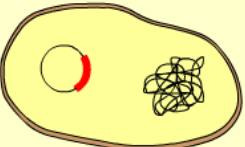
Recombinant DNA Activity:

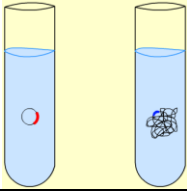
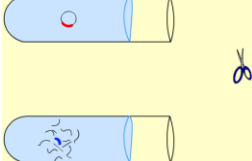
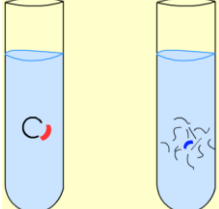
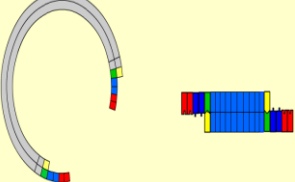
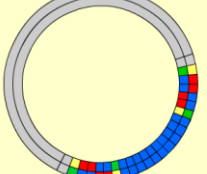
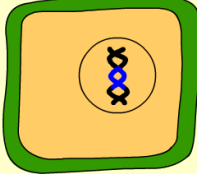

Go to the following link: http://www.hhmi.org/biointeractive/dna/DNAi_genetic_eng.html

1. Fill in the blanks from the paragraph:

A new gene can be _____ into a _____ called a _____. This is done by _____ with a _____, which allows a _____. The ends of the new piece of DNA are _____ by an enzyme called _____. The genetically engineered bacteria will now _____.

Go to the following link: <http://www.biotech.ubc.ca/TeachingResources/Applications/GMOpkgJKloseGLampard2.swf>. This animation will show you the steps of creating recombinant DNA and making a transgenic plant. Answer the following questions.

Picture	Text
	
	
 <p data-bbox="183 1717 337 1751">both screens</p>	<ul style="list-style-type: none"> • •
	

	
	
	
	
	
	
	
<p>Summarize the entire process of creating recombinant DNA and a transgenic plant (you may use pictures and words)</p>	