

Recombinant DNA LAB - Making Paper Plasmids

Standard: 5c

Objective:

To understand how genes can be inserted into another DNA - "recombine"

To conceptualize "restriction enzymes" and recognition of specific sites

Students will model the process of using restriction enzymes and plasmids to form recombinant DNA.

The "Recombinant DNA Lab" activity can help you see how genes may be manipulated for genetic research, namely, gene cloning/genetic engineering. This activity will help you conceptualize the mechanics involved in cutting and ligating DNAs into a plasmid vector with "sticky ends" of complementary DNA base pairs.

Background Information

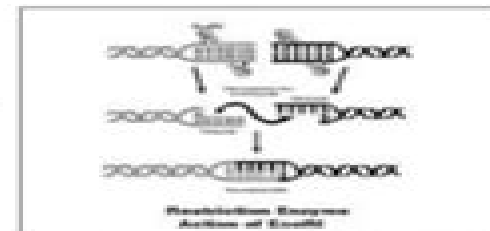
Recombinant DNA technology is one of the new techniques of biotechnology. Biotechnology uses living organisms to carry out chemical processes or to produce substances, combining biology with chemistry and science with industry. Biotechnology includes the field of **genetic engineering**, which is the science of directly manipulating genes to produce recombinant DNA. Genetic engineering techniques are used in a variety of industries, in agriculture, in basic research, and in medicine.

Through genetic engineering, there is great potential for the development of useful products. Researchers have already developed sources of interferon, human growth hormone, insulin, and resistant fruits and vegetables. A gene coding for a particular protein is transferred into a host organism. The host organism reproduces and the population produces the desired protein in volume. For example, the gene that codes for the production of human insulin has been inserted into the common bacterium *E. coli*. Then the bacteria can be grown in huge containers and large amounts of insulin can be collected.

As an introduction to recombinant DNA technology, the exercise that follows illustrates on paper some of the steps of recombinant DNA experiments done in laboratories.

Steps to Recombination

1. Scientists must first **identify the gene** that codes for the production of the protein they want to manufacture.
2. Next scientists must **isolate the desired gene**. Restriction enzymes from bacterial cells are important in this step. Each **restriction enzyme** recognizes and cleaves (cuts) a very specific sequence of DNA called a **restriction site**. Some restriction enzymes make a staggered cut of the DNA producing **sticky ends** or single strands of unpaired nucleotide bases capable of binding with complementary sticky ends. By using restriction enzymes that will cut the DNA on either side of the gene, the desired gene can be clipped out of the DNA strand.
3. Once the desired gene has been isolated scientists must then **insert the gene into a plasmid**. **Plasmids** are small circular pieces of DNA found naturally in most bacteria. The plasmid must be removed from a bacterium and cleaved with the same restriction enzyme used to isolate the gene. This way the sticky ends of the plasmid will match those of the gene.



Recombinant Paper Plasmids Lab Answers

Victor M. Corman



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