

# Restriction Enzyme Encyclopedia Article

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# Restriction Enzyme

Deoxyribonucleic acid ( DNA) analysis took a leap forward when a Swiss microbiologist, Werner Arber, discovered bacterial substances called restriction enzymes. These enzymes were first detected while scientists were experimenting with a particular chromosome, called lambda, of a virus known to infect bacteria cells.

Such viruses are named temperate bacteriophages. When these bacteriophages infect a bacteria cell, several events may occur. The attacking bacteriophages can enter the bacteria cell and set up an infectious cycle using the bacteria's cellular apparatus to construct more virus particles. The attacking substance may also enter the bacteria cell and actually become integrated as part of the bacteria cell's own chromosome. Each time the bacteria cell replicates, so does the bacteriophage.

Scientists studying this phenomenon soon noticed that the lambda bacteriophages produced by one type of bacteria cell were often unable to infect other types of bacteria. In 1968, Arber determined that this situation arose because of the presence of restriction enzymes that were produced by the bacteria cells. These special enzymes alter the DNA code of the bacteriophage by "reading" the code and then cutting it at specific sites. Without a complete set of genetic instructions, the altered bacteriophage is inactivated and therefore unable to infect the bacteria cell.

More than 100 different restriction enzymes have now been discovered in various bacteria cells. These enzymes are used like molecular scissors to cleave DNA. This helps researchers determine the complete sequence of the DNA code. This procedure is often referred to as DNA sequencing. Some enzymes don't cut straight across the DNA chain. This makes it possible to mix and match segments of DNA from different organisms. These rearranged DNA molecules are called *chimeras* after a mythological creature that was part lion, part goat, and part snake. It is now possible to recombine or splice together DNA segments in an endless variety. Since DNA is like a blue print that essentially tells the cell what to do, scientists can alter DNA so that cells produce new products, such as human insulin and human factor VIII (used for male hemophiliacs).