Discovery of Recombinant

Stanley Norman Cohen

Stanley Norman Cohen is an American geneticist.

Originally from Perth Amboy, New Jersey, Cohen is a graduate of Rutgers University, and received his doctoral degree from the University of Pennsylvania School of Medicine in 1960. Following subsequent training at various institutions, including the National Institutes of Health, he joined the faculty of Stanford University in 1968.

It was there that he began to explore the field of bacterial plasmids. He wanted to understand how the genes of plasmids could make bacteria resistant to antibiotics. In 1972, Cohen's investigations, combined with those of Herbert Boyer, led to the development of methods to combine and transplant genes. This discovery signalled the birth of genetic engineering, and he received National Medal of Science (1988) in his honor. Today, Cohen is a professor of genetics and medicine at Stanford, where he works on a variety of scientific problems including cell growth and development.

Experiment

Stanley Cohen and Herbert Boyer made what would be one of the first genetic engineering experiments, in 1973. They demonstrated that the gene for frog ribosomal RNA could be transferred into bacterial cells and expressed by them. First they constructed a plasmid, which would be the vector, called pSC101. This plasmid contained a single site for the restriction enzyme EcoRI and a gene for tetracycline resistance. The restriction enzyme EcoRI was used to cleave the frog DNA into small segments. Next, the frog DNA fragments were combined with the plasmid, which had also been cleaved with EcoRI. The sticky ends of the DNA segments aligned themselves and were afterwards joined together using DNA ligase. The plasmids were then transferred into a strain of E. coli and plated onto a growth medium containing tetracycline. The cells that incorporated the plasmid carrying the tetracycline gene grew and formed a colony of bacteria. Some of these colonies consisted of cells that carried the frog ribosomal RNA gene. The scientists then tested the colonies that formed after growth for the presence of frog ribosomal DNA.

Paul Berg

Molecular biologist who in 1972 created the first recombinant DNA molecules, and, in doing so, created the field of genetic engineering.

Berg, born in Brooklyn, New York, attended Case Western Reserve University, and in 1952, obtained a Ph. D. in biochemistry. He became a Stanford professor in 1959.

Berg, in** 1972**, combined DNA from the cancer-causing monkey virus SV40 with that of the virus lambda to create the first recombinant DNA molecules. However, upon realizing the dangers of his experiment, terminated it before it could be taken any further. He immediately, in what is now called the "Berg Letter," proposed a one year moratorium on recombinant DNA research, in order for safety concerns to be worked out. Berg later continued his recombinant DNA research, and was awarded the 1980 Nobel Prize in chemistry.

In 1991, Berg accepted a position as the head of the Scientific Advisory Committee of the **Human Genome Project**.

1972: The first recombinant DNA molecules.

Paul Berg
In 1972, **Paul Berg** of Stanford University created the first **recombinant DNA** molecules by combining the **DNA** of two different organisms.

Berg used a **restriction enzyme** to isolate a **gene** from a human cancer-causing monkey virus. Then, he used ligase to join the section of virus DNA with a molecule of DNA from the bacterial virus lambda, creating the first recombinant DNA molecule. Berg realized the dangers of his experiment and temporarily terminated it before the recombinant DNA molecule was ***added to E. Coli***, where it would have been quickly reproduced. Following the termination of his experiment, he proposed a one year moratorium on recombinant DNA studies while safety issues where addressed.

Berg later resumed his studies into recombinant DNA techniques, and was awarded the 1980 Nobel Prize in chemistry. His discoveries laid the foundation for field of **genetic engineering**, and the modern **biotechnology** industry.

1973: The first recombinant DNA organisms.

StanleyCohen

Herbert Boyer
In 1973, **Stanley Cohen** and **Herbert Boyer** created the ***first recombinant DNA organism*** using **recombinant DNA** techniques pioneered a year earlier by Paul Berg. Recombinant DNA, also called **gene splicing,** is a technique that allows scientists to manipulate the **DNA** of an organism. Cohen and Boyer's implementation of the technique laid the foundations for today's modern **genetic engineering** industry.

Stanley Cohen had developed a means to extract plasmids from cells and implant them in other cells. Herbert Boyer had determined how to use restriction enzymes to cut certain sequences of nucleotides from a strand of DNA. In 1973 Cohen and Boyer combined their research to produce recombinant DNA organisms.

Cohen and Boyer removed **plasmids**, small rings of DNA located in a cell's **cytoplasm**, not the **nucleus**, from a cell. Then they used restriction enzymes to cut the DNA at precise locations and then recombined the DNA

strands in the special configurations that they desired. Finally, ***Cohen and Boyer inserted the spliced DNA into E. Coli bacteria cells*** which reproduced the altered DNA. With altered DNA, the bacteria cells could be made to produce specific proteins. Today's biotechnology corporations implement recombinant DNA technology to get bacteria to act as biological manufacturers of proteins valuable in science, medicine and agriculture.

Herbert Boyer

American biochemist who pioneered the development of **recombinant DNA** organisms with **Stanley Cohen** in 1973 and later became a co-founder of **Gerentech**, one of the first **biotechnology** corporations.

Boyer, born in Pennsylvania, entered the pre-med program at St. Vincent's College in Pennsylvania, but graduated with degrees in biology and chemistry. He conducted his postgraduate work at the University of Pittsburgh and at Yale, and in 1966 landed an assistant professorship position at the University of California San Francisco.

At the University of California San Francisco, Boyer studied **restriction enzymes** found in the bacteria E. Coli that sliced **DNA** in a way the ends could be attached back together. In **1973**, Boyer teamed up with **Stanley Cohen** of Stanford University to produce the world's first recombinant DNA organism, and with their accomplishment, set the foundation for modern biotechnology.

In 1976, Boyer and Robert Swanson founded Gerentech, one of the first major biotechnology corporations specializing in producing commercial organisms using recombinant DNA technology. In 1978, Gerentech was successful in synthesizing human **insulin**.