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# Recombinant DNA Techniques: Editorial Note

**S Ravichandran***

School of Chemical Engineering and Physical Sciences, Lovely Professional University, India

***Corresponding author**: S Ravichandran, School of Chemical Engineering and Physical Sciences, Lovely Professional University, India, E-Mail: ravichandran.23324@lpu.co.in

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## Ediorial Note

Recombinant DNA, molecules of DNA from two different species that are inserted into a host organism to produce new genetic combinations that are of value to science, medicine, agriculture, and industry. Since the focus of all genetics is the gene, the fundamental goal of laboratory geneticists is to isolate, characterize, and manipulate genes. Although it is relatively easy to isolate a sample of DNA from a collection of cells, finding a specific gene within this DNA sample can be compared to finding a needle in a haystack. Consider the fact that each human cell contains approximately 2 metres (6 feet) of DNA. Therefore, a small tissue sample will contain many kilometres of DNA. However, recombinant DNA technology has made it possible to isolate one gene or any other segment of DNA, enabling researchers to determine its nucleotide sequence, study its transcripts, mutate it in highly specific ways, and reinsert the modified sequence into a living organism.

## DNA Cloning

In biology a clone is a group of individual cells or organisms descended from one progenitor [1]. This means that the members of a clone are genetically identical, because cell replication produces identical daughter cells each time. The use of the word clone has been extended to recombinant DNA technology, which has provided scientists with the ability to produce many copies of a single fragment of DNA, such as a gene, creating identical copies that constitute a DNA clone [2]. In practice the procedure is carried out by inserting a DNA fragment into a small DNA molecule and then allowing this molecule to replicate inside a simple living cell such as a bacterium [3]. The small replicating molecule is called a DNA vector (carrier) [4]. The most commonly used vectors are plasmids (circular DNA molecules that originated from bacteria), viruses, and yeast cells [5]. Plasmids are not a part of the main cellular genome, but they can carry genes that provide the host cell with useful properties, such as drug resistance, mating ability, and toxin production. They are small enough to be conveniently manipulated experimentally, and, furthermore, they will carry extra DNA that is spliced into them.

## DNA Sequencing

Once a segment of DNA has been cloned, its nucleotide sequence can be determined. The nucleotide sequence is the most fundamental level of knowledge of a gene or genome [6]. It is the blueprint that contains the instructions for building an organism, and no understanding of genetic function or evolution could be complete without obtaining this information.

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## Invention of Recombinant DNA Technology

Recombinant DNA technology was invented largely through the work of American biochemists Stanley N. Cohen, Herbert W. Boyer, and Paul Berg [7]. In the early 1970s Berg carried out the first successful gene-splicing experiment, in which he combined DNA from two different viruses to form a recombinant DNA molecule. Boyer and Cohen then took the next step of inserting recombinant DNA molecules into bacteria, which replicated, creating many copies of the recombinant molecule. Boyer and Cohen subsequently developed methods for the generation of recombinant plasmids. In 1976, with Robert A. Swanson, Boyer founded the company Genentech, which commercialized Boyer and Cohen's recombinant DNA technology.

In 1968—prior to the work of Berg, Boyer, and Cohen—Swiss microbiologist Werner Arber discovered restriction enzymes. American microbiologist Hamilton O. Smith subsequently identified type II restriction enzymes [8]. Unlike type I restriction enzymes, which cut DNA at random sites, type II restriction enzymes cleave DNA at specific sites; hence, type II enzymes became important tools in genetic engineering.

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