Endonuclease

Endonucleases are enzymes that cleave the phosphodiester bond within a polynucleotide chain. Some, such as Deoxyribonuclease I, cut DNA relatively nonspecifically (without regard to sequence), while many, typically called restriction endonucleases or restriction enzymes, cleave only at very specific nucleotide sequences.

Restriction enzymes are endonucleases from eubacteria and archaea that recognize a specific DNA sequence.

The nucleotide sequence recognized for cleavage by a restriction enzyme is called the restriction site. Typically, a restriction site will be a palindromic sequence about four to six nucleotides long. Most restriction endonucleases cleave the DNA strand unevenly, leaving complementary single-stranded ends. These ends can reconnect through hybridization and are termed “sticky ends”. Once paired, the phosphodiester bonds of the fragments can be joined by DNA ligase. There are hundreds of restriction endonucleases known, each attacking a different restriction site. The DNA fragments cleaved by the same endonuclease can be joined together regardless of the origin of the DNA. Such DNA is called recombinant DNA; DNA formed by the joining of genes into new combinations.

Restriction endonucleases (restriction enzymes) are divided into three categories, Type I, Type II, and Type III, according to their mechanism of action. These enzymes are often used in genetic engineering to make recombinant DNA for introduction into bacterial, plant, or animal cells, as well as in synthetic biology.

The RNAse III endonuclease DICER is a key regulator of microRNA (MicroRNA) biogenesis and is frequently decreased in a variety of malignancies.