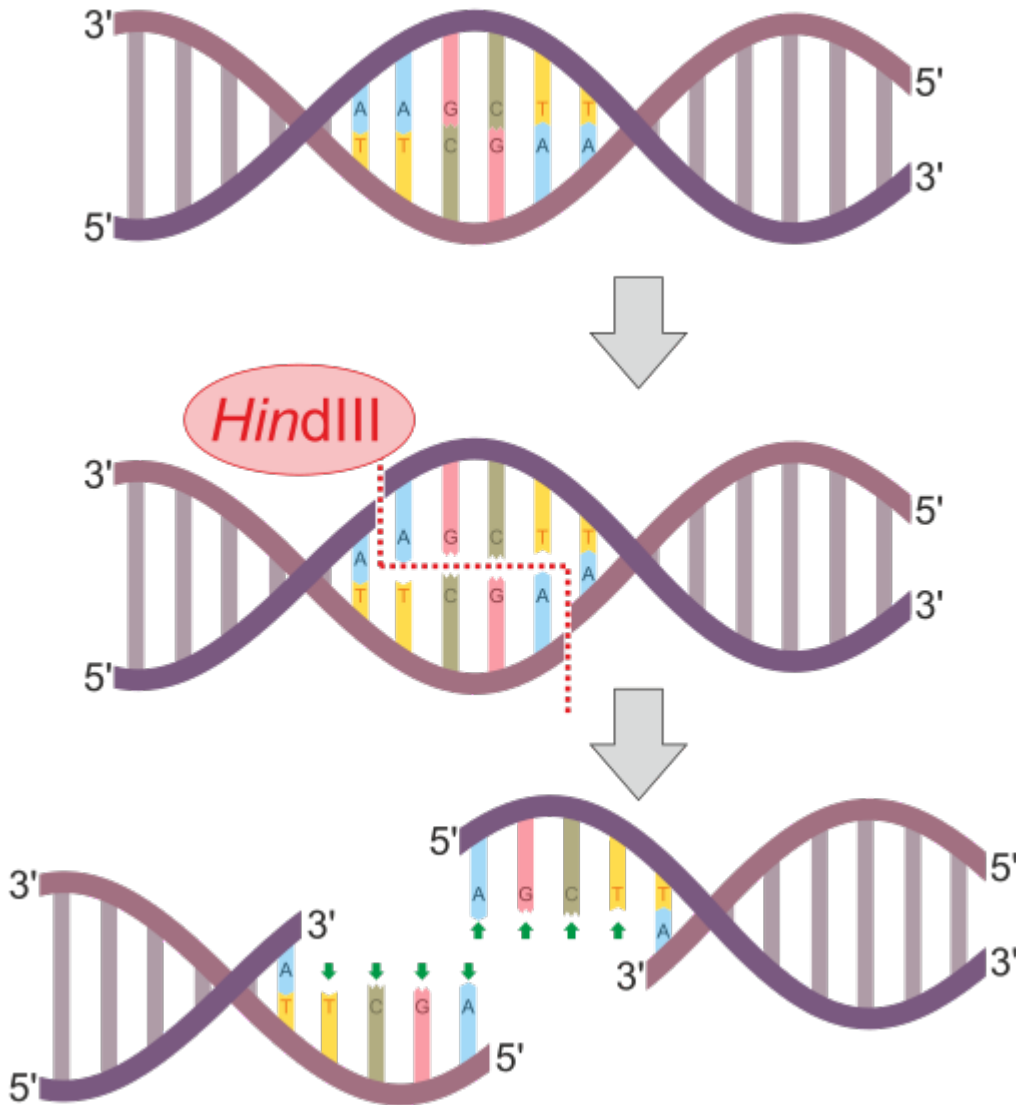


DNA can be cut by **restriction endonucleases (RE)**. Endonucleases are enzymes that can hydrolyze the nucleic acid polymer by breaking the **phosphodiester** bond between the phosphate and the pentose on the nucleic acid backbone. This is a very strong covalent bond while the weaker hydrogen bonds maintain their interactions and double strandedness.

As the name implies, restriction endonucleases (or restriction enzymes) are “*restricted*” in their ability to cut or digest DNA. The restriction that is useful to biologists is usually **palindromic** DNA sequences. Palindromic sequences are the same sequence forwards and backwards. Some examples of palindromes: RACE CAR, CIVIC, A MAN A PLAN A CANAL PANAMA. With respect to DNA, there are 2 strands that run antiparallel to each other. Therefore, the reverse complement of one strand is identical to the other. Molecular biologists also tend to use these special molecular scissors that recognize palindromes of 6 or 8. By using 6-cutters or 8-cutters, the sequences occur throughout large stretches rarely, but often enough to be of utility.



Restriction Enzymes



GAATTC
CTTAAG

*Eco*RI generates
sticky or
cohesive ends

CCCGGG
GGGCCC

*Sma*I generates
blunt ends



Restriction enzymes hydrolyze covalent phosphodiester bonds of the DNA to leave either “sticky/cohesive” ends or “blunt” ends. This distinction in cutting is important because an *EcoRI* sticky end can be used to match up a piece of DNA cut with the same enzyme in order to glue or ligate them back together. While endonucleases cut DNA, **ligases** join them back together. DNA digested with *EcoRI* can be ligated back together with another piece of DNA digested with *EcoRI*, but not to a piece digested with *SmaI*. Another blunt cutter is *EcoRV* with a recognition sequence of GAT | ATC.

Restriction Digestions

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