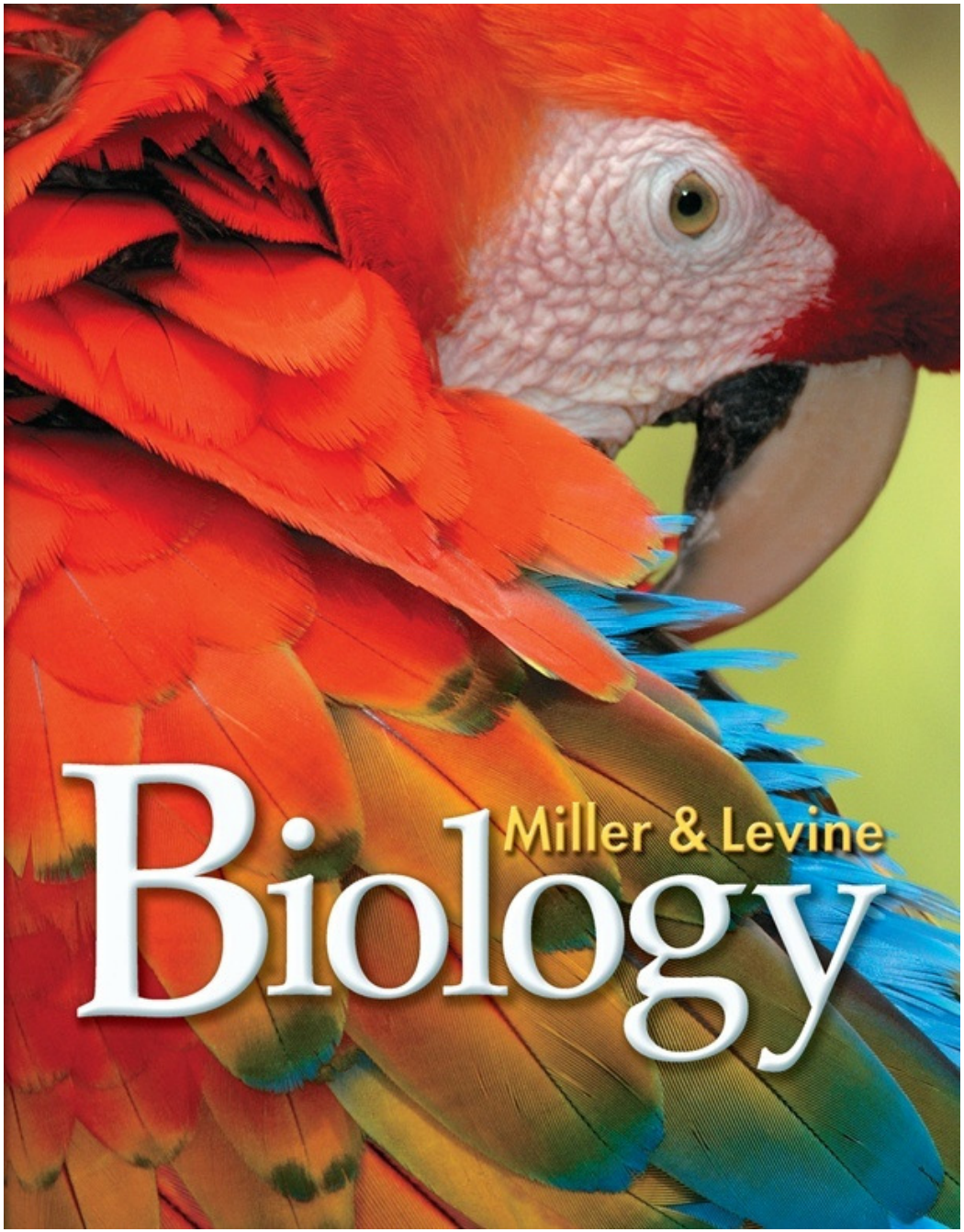

Lesson Overview

14.3 Studying the Human Genome

Manipulating DNA

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- This difference makes DNA relatively easy to extract from cells and tissues.

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- This difference makes DNA relatively easy to extract from cells and tissues.
- DNA molecules from most organisms are much too large to be analyzed, so they must first be cut into smaller pieces.

Manipulating DNA

Many bacteria produce restriction enzymes that cut DNA molecules into precise pieces, called restriction fragments that are several hundred bases in length.

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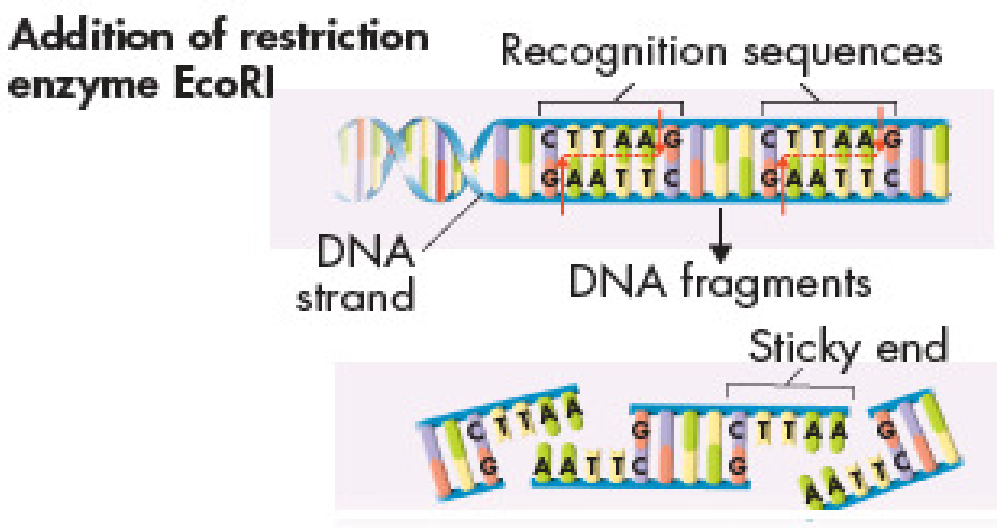
- Of the hundreds of known restriction enzymes, each cuts DNA at a different sequence of nucleotides.

Manipulating DNA

For example, the *EcoRI* restriction enzyme recognizes the base sequence GAATTC.

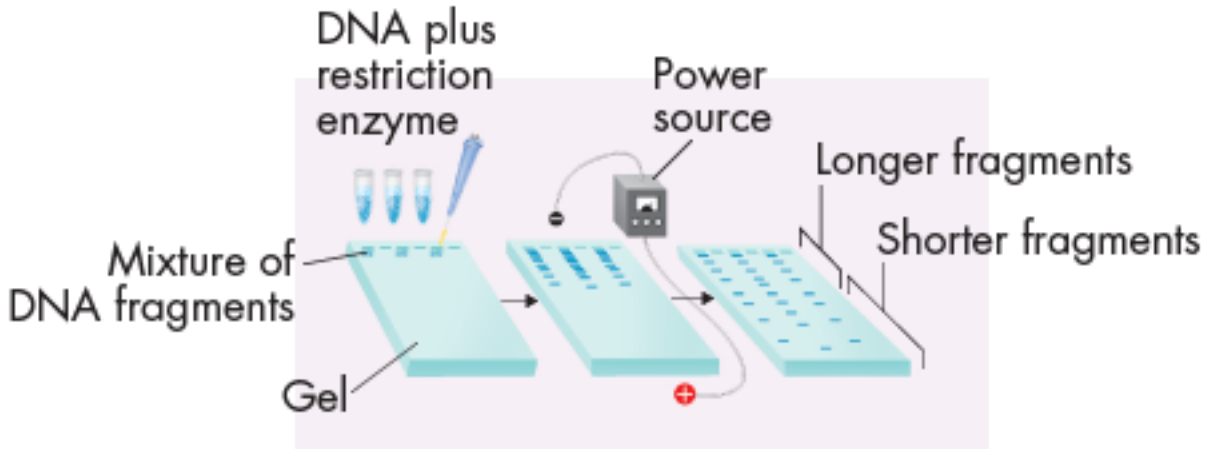
It cuts each strand between the G and A bases, leaving single-stranded overhangs, called sticky ends, with the sequence AATT.

The sticky ends can bond, or stick, to a DNA fragment with the complementary base sequence.



Manipulating DNA

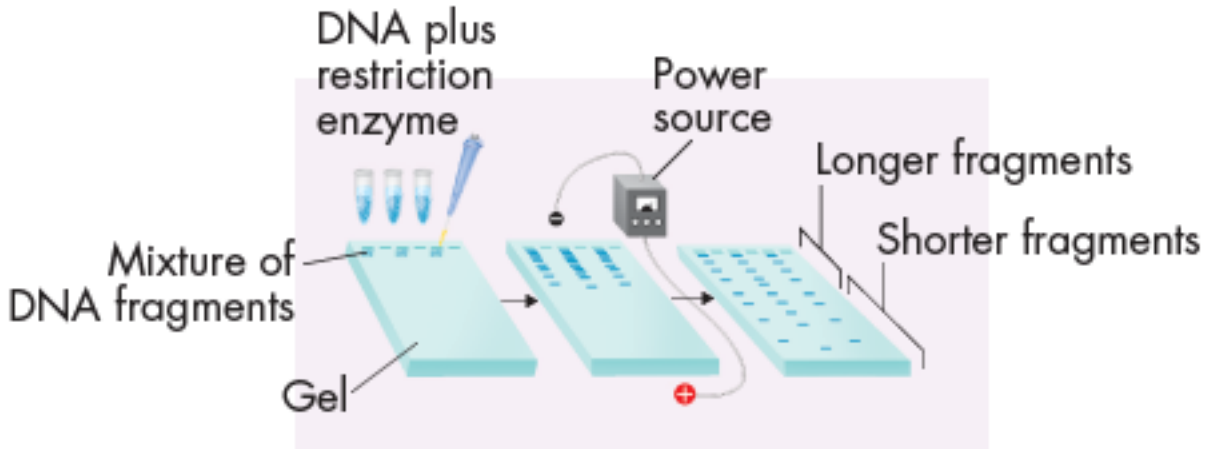
Once DNA has been cut by restriction enzymes, scientists can use a technique known as gel electrophoresis to separate and analyze the differently sized fragments.



Manipulating DNA

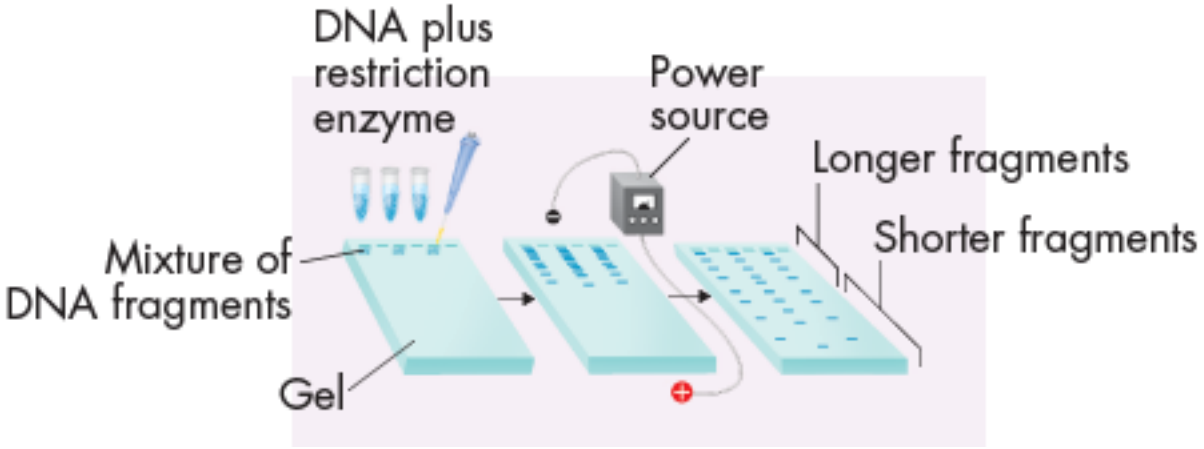
Once DNA has been cut by restriction enzymes, scientists can use a technique known as gel electrophoresis to separate and analyze the differently sized fragments.

- A mixture of DNA fragments is placed at one end of a porous gel.



Manipulating DNA

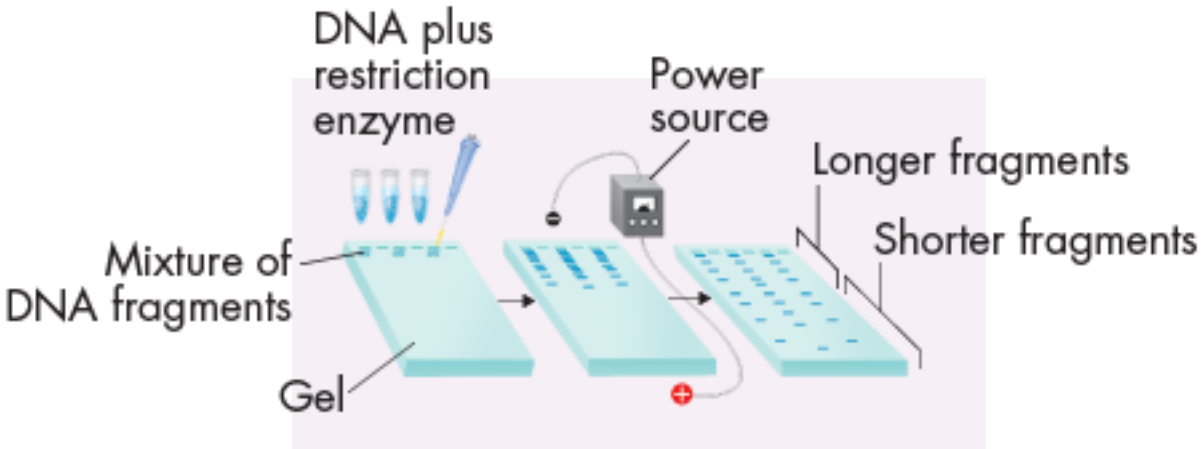
- When an electric voltage is applied to the gel, DNA molecules (which are negatively charged) move toward the positive end of the gel.



Manipulating DNA

- When an electric voltage is applied to the gel, DNA molecules (which are negatively charged) move toward the positive end of the gel.

- The smaller the DNA fragment, the faster and farther it moves.

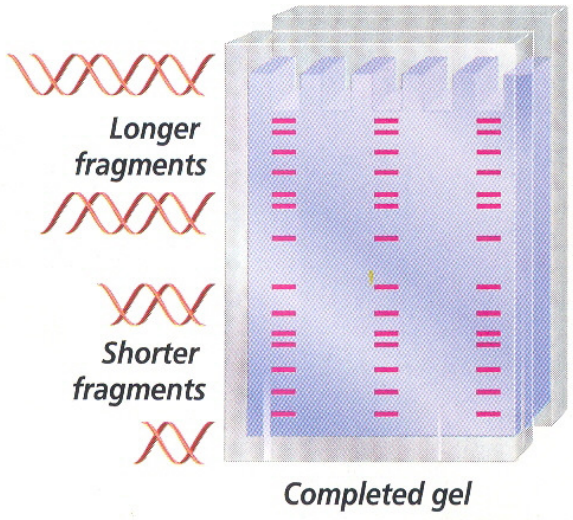


Manipulating DNA

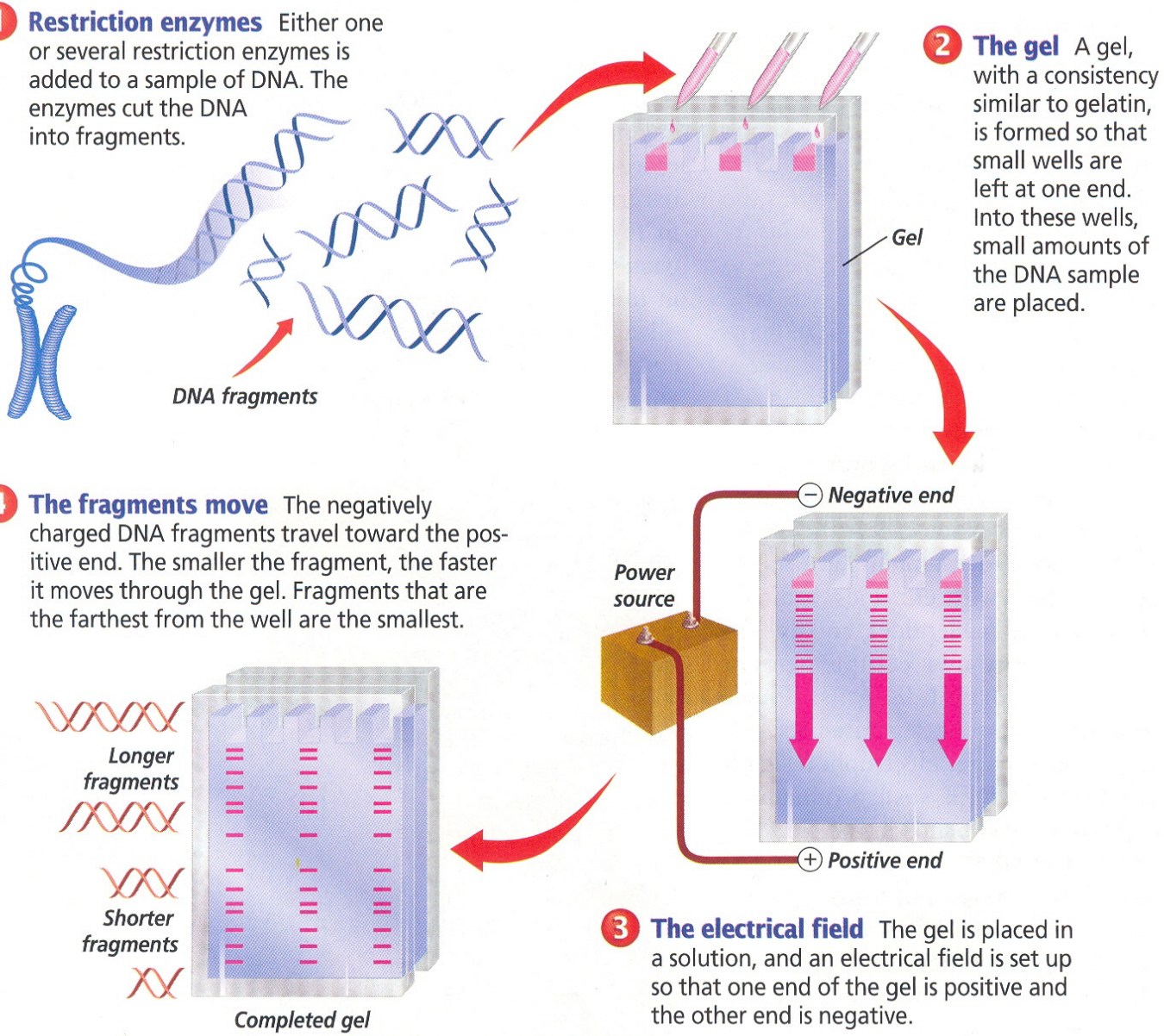
The result is a pattern of bands based on fragment size.

Specific stains that bind to DNA make these bands visible.

Researchers can remove individual restriction fragments from the gel and study them further.



Overview of Gel Electrophoresis



Manipulating DNA

Polymerase chain reaction (PCR) is a technique that allows scientists to analyze very small samples of DNA.

Gel electrophoresis (also called restriction fragment length polymorphism – RFLP) requires relatively large amounts of high quality DNA.

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Gel electrophoresis (also called restriction fragment length polymorphism – RFLP) requires relatively large amounts of high quality DNA.

- PCR is used to make millions of copies of a particular DNA sequence.

Scientists use PCR to amplify sections of DNA that scientists have identified as being highly variable amongst individuals.

Manipulating DNA

Polymerase Chain Reaction (PCR) Process…

- Step One = Heat the DNA (this separates the two strands)
- Step Two = As the DNA cools, primers bind to the DNA strands
- Step Three = DNA polymerase starts copying the region between the primers
- Step Four = The process is repeated to make additional copies of the gene sequence

Manipulating DNA

Recombinant DNA technology uses the same premise as DNA profiling to recombine genes.

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- Recombinant DNA is a form of artificial DNA that is created by combining two or more sequences that would not normally occur together.

Typically, the DNA from the desired gene is inserted into a bacterial plasmid.

Manipulating DNA

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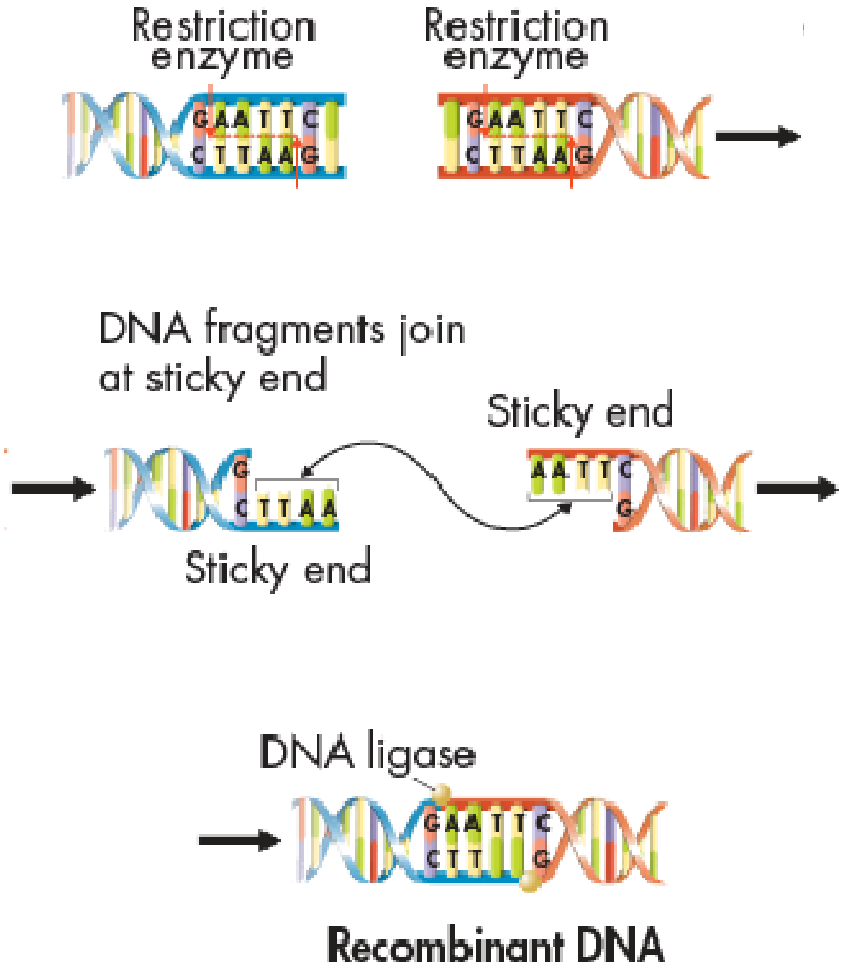
- Recombinant DNA is a form of artificial DNA that is created by combining two or more sequences that would not normally occur together.

Typically, the DNA from the desired gene is inserted into a bacterial plasmid.

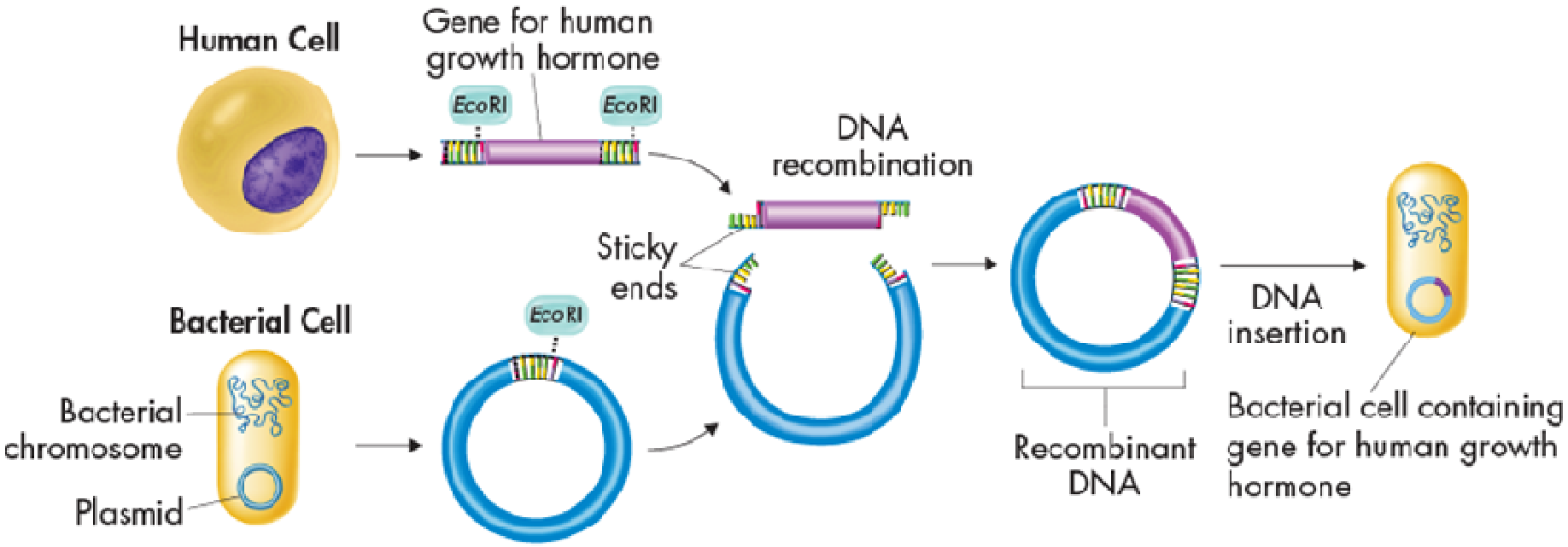
- The bacterial cell will then create the protein that the desired gene codes for.

Manipulating DNA



Manipulating DNA

Recombinant DNA Technology – Plasmid DNA Transformation



Manipulating DNA

Recombinant DNA Technology – Plasmid DNA Transformation