

Genetic Engineering

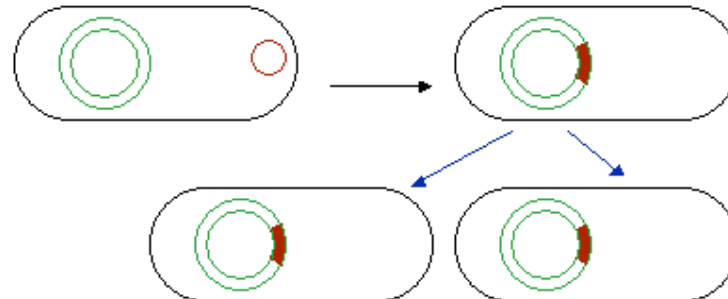
Recombinant DNA Technology

- [Recombinant DNA](#) - transfer of genetic material between organisms of the same or different species
- DNA recombination occurs naturally
 - sexual reproduction
 - bacterial transformation
 - viral transfer of DNA

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Recombinant DNA Technology

- By transferring the gene for a desired protein product into a bacterium, proteins can be produced in large quantities



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In Animals & Plants

- Technique:
 - microinjection of gametes / embryos
 - gene gun for plant transformations
- Applications:
 - improved quantity/quality of meat/crop products
 - resistance to environmental stress
 - production of pharmaceutical (“pharming”)
 - models of genetic disease

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Recombinant DNA Technology

- Humulin (human insulin) the world's first genetically engineered pharmaceutical product.
 - Prior to that, diabetes was treated using insulin from cows and pigs.
- DNA technology is also helping medical researchers develop vaccines.
 - **Vaccine** is a harmless variant or derivative of a pathogen.

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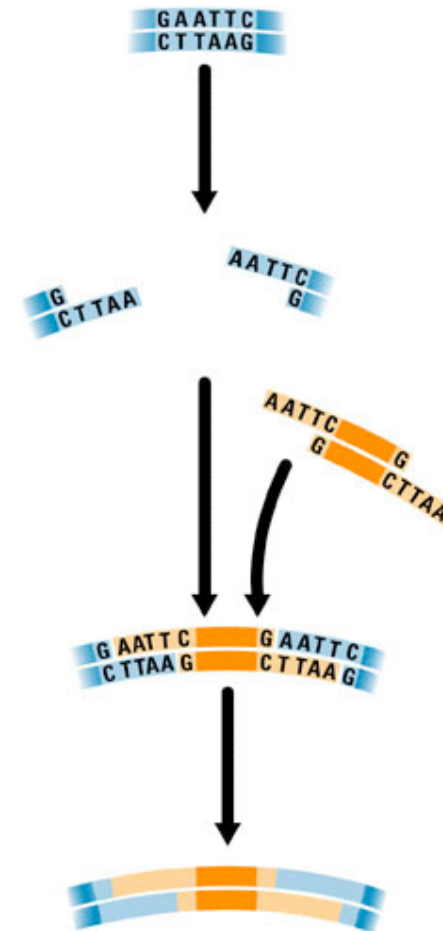
Just “Cut and Paste”

- Recombinant DNA is produced by combining two ingredients:
 - Bacterial plasmid
 - Gene of interest
- To combine these ingredients, a piece of DNA must be “pasted” into a [plasmid](#)
 - small circular DNA molecules which are separate from chromosomal DNA

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Just “Cut and Paste”

- “Pasting” process is accomplished by using [restriction enzymes](#).
 - Enzymes that cut DNA at specific nucleotide sequences.
 - The places where DNA is cut are called [restriction sites](#).



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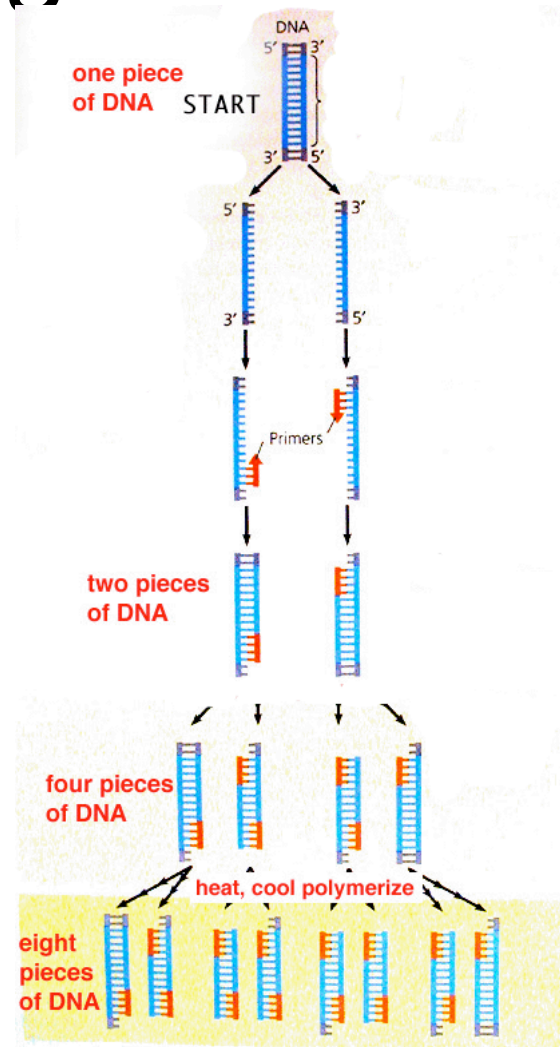
DNA Fingerprinting

- **Forensics** is the scientific analysis of evidence from crime scenes.
- DNA fingerprinting can be used to determine whether or not two samples of genetic material are from the same individual.

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DNA Fingerprinting Techniques

- Polymerase chain reaction (PCR) is a technique by which any segment of DNA can be amplified (cloned)
- Obtain enough DNA from even small amounts of blood to allow DNA fingerprinting



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DNA Fingerprinting

- DNA fingerprinting relies on indirect methods to compare samples
- One method is called Restriction Fragment Length Polymorphism (RFLP) Analysis
 - the comparison of a set of restriction fragments produced by DNA from different individuals

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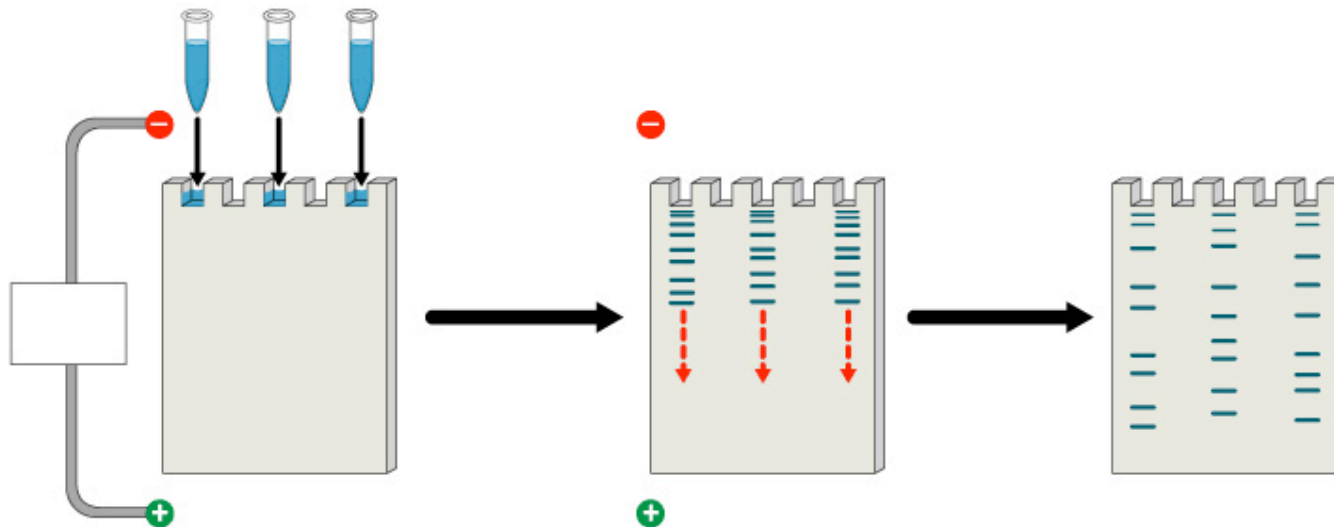
RFLP Analysis Method

- DNA from an individual specimen is first extracted and purified. (amplified by PCR).
- The DNA is then cut into *restriction fragments* by endonucleases, which only cut where there are specific DNA sequences recognized by the enzymes.
- The restriction fragments are then separated according to length by [agarose gel electrophoresis](#).

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Gel Electrophoresis

- A method for sorting these fragments based on their length and electrical charge



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RFLP Analysis Results

- The distance between the locations cut by restriction enzymes (*restriction sites*) varies between individuals.
- This can be used to genetically tell individuals apart.
- It can also show the genetic relationship between individuals, children from parents and relationships among species.

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Ethics & Biotechnology

- Designer children
- Accessibility of treatment
- Availability of *your* genetic info?
 - insurance
 - employment
- *News flash ...*World opposition to “Frankenfoods” growing.
- *News Flash ...* Taco Bell or Taco Hell? Taco Bell announces a nationwide recall of taco shells that tested positive for an unapproved biotech corn.