

Chapter 13
Biotechnology

I. What is Biotechnology?

- A. **Biotechnology** - any industrial or commercial use or alteration of organisms, cell, or biological molecules to achieve specific goals
- B. **Selective Breeding** - The breeding of specific parents to choose or magnify traits in the offspring (old-style biotechnology)
- C. **Genetic Engineering** - the modification of genetic material to achieve specific goals
- D. **Recombinant DNA** - DNA that contains genes or parts of genes from different organisms
- E. **Transgenic, or Genetically Modified Organisms (GMO)** - Organisms that express DNA that has been modified or derived from a separate organism

II. How does DNA recombination occur in nature?

- A. Recombination of genetic material can occur spontaneously in nature
- B. Transformation may combine DNA from different bacterial species
 - 1. **Transformation** - the ability of certain bacteria to acquire DNA from the environment
 - 2. The uptake of DNA could be either a mechanism of adaptation or a survival mechanism to deal with starvation.
- C. Viruses may transfer DNA between bacteria and between eukaryotic species
 - 1. Viruses are nonliving genetic constructs that can invade and overtake a host's machinery
 - 2. Viral duplication is very inexact, sometimes packaging pieces of host DNA into viral shells, creating **defective virions**
 - 3. Defective virions can infect other cells and pass on the included host DNA

III. How is biotechnology used in forensics?

- A. The explosion of DNA forensics results from the invention of the Polymerase Chain Reaction (PCR) in 1986.
- B. The PCR Procedure

- C. The construction of the primers in PCR allows for the amplification of very specific sequences
- D. Forensics focuses on regions called Short Tandem Repeats (STR), a match of 10 STR regions give a 1:1,000,000,000,000 identification of a suspect
- E. Amplified DNA is separated by electrophoresis.
- F. The patterns of STR give a suspect's **DNA fingerprint**

IV. How is biotechnology used in agriculture?

- A. Many of our crops are genetically engineered.
- B. Engineering
 - 1. The desired gene is cloned
 - 2. **Restriction enzymes** are used to cut specific nucleotide sequences
 - 3. Cutting two pieces with the same restriction enzyme allows the pieces to be joined together
 - 4. Plasmids are used to shuttle recombinant DNA

V. How is biotechnology used for medical diagnosis and treatment?

- A. DNA can be used to diagnose genetic diseases
- B. DNA Technology used to treat disease.