

# Biotechnology

## Chapter 21



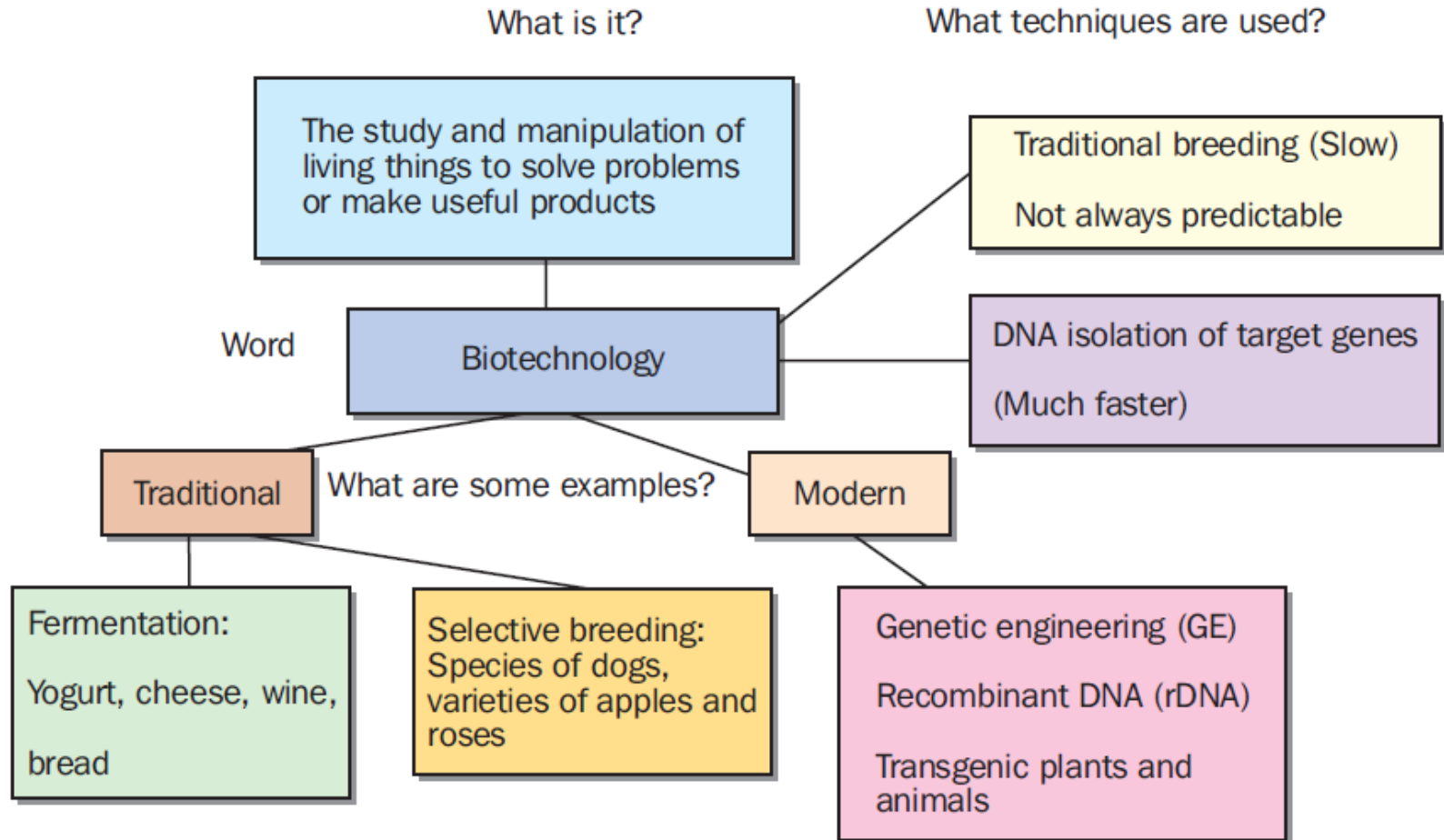
# What is biotechnology?

Biotechnology comes from the words:

- “***biology***” - the study of living organisms
- “***technology***” - the use of tools and crafts to adapt or control one’s environment
- ***Biotechnology*** is the study and manipulation of living things to solve problems or make useful products.

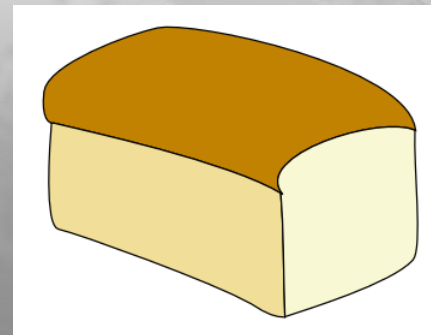


# BIOTECHNOLOGY DEFINED



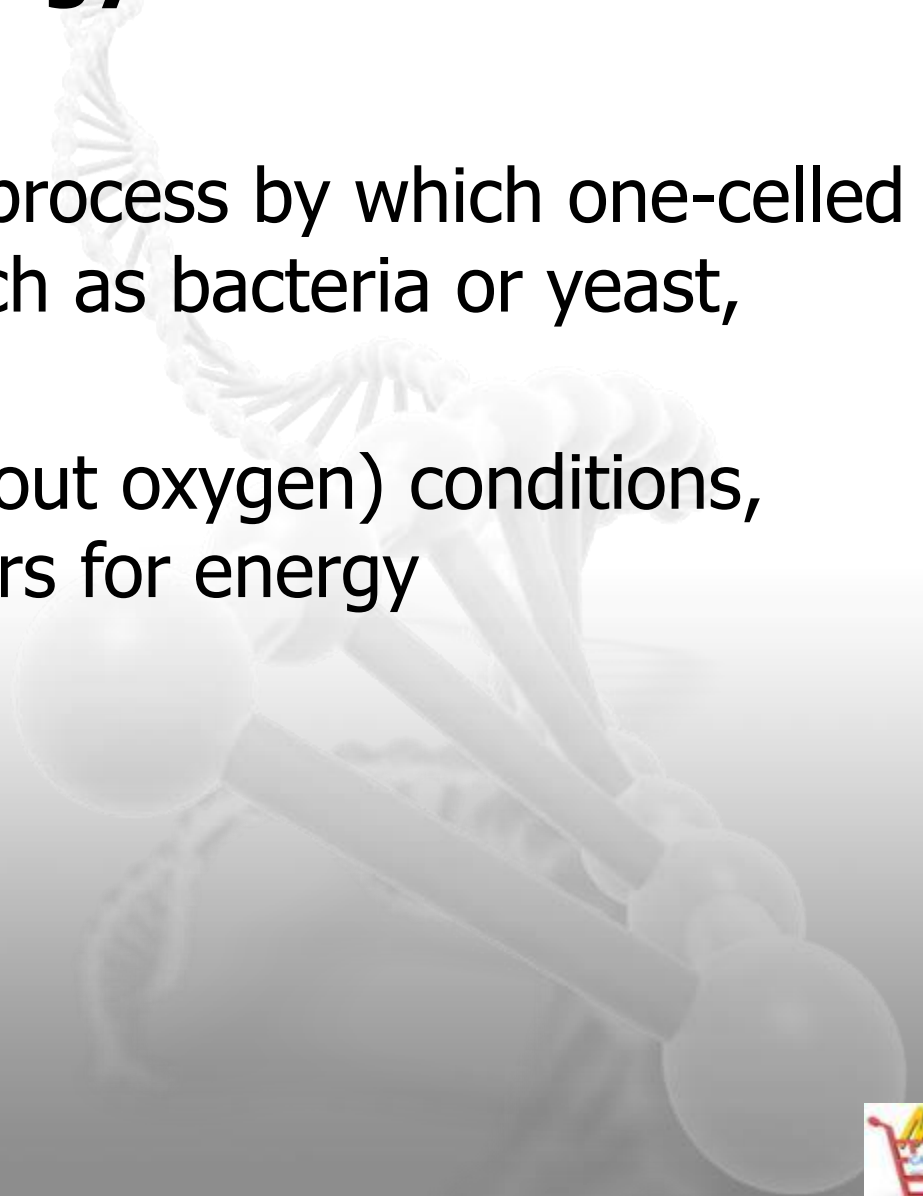
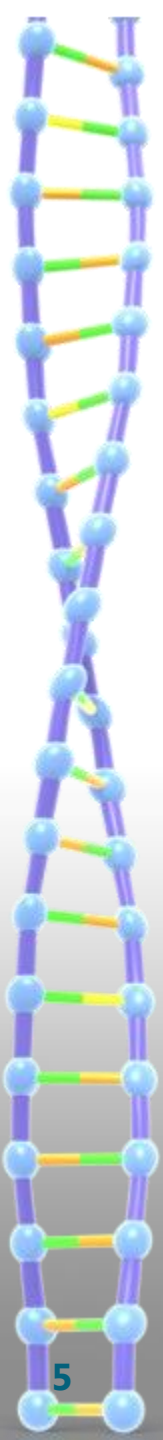
# What is biotechnology ?

- Thousands of years ago, the Aztec Indians used biotechnology:
  - Inventing corn, or maize
  - Crossed/hybridized a grass named tiachintae
  - Products of fermentation (bread, wine, beer)



# What is biotechnology ?

- ***Fermentation*** is a process by which one-celled microorganisms, such as bacteria or yeast, when grown in
  - ***anaerobic*** (without oxygen) conditions, break down sugars for energy



# What is biotechnology ?

- *Selective breeding*, choosing certain animals or plants with desirable traits to mate or to cross pollinate.
  - Allowed early farmers to produce stronger generations of offspring
  - Time consuming, not always resulting in desired characteristics.





# What is biotechnology ?

- ***Hybrids*** are crosses between two homozygous or sometimes true-breeding organisms of different varieties.
- The ***gene pool***, all the genes in a population of plants or animals, is limited in traditional breeding.



# What is biotechnology?

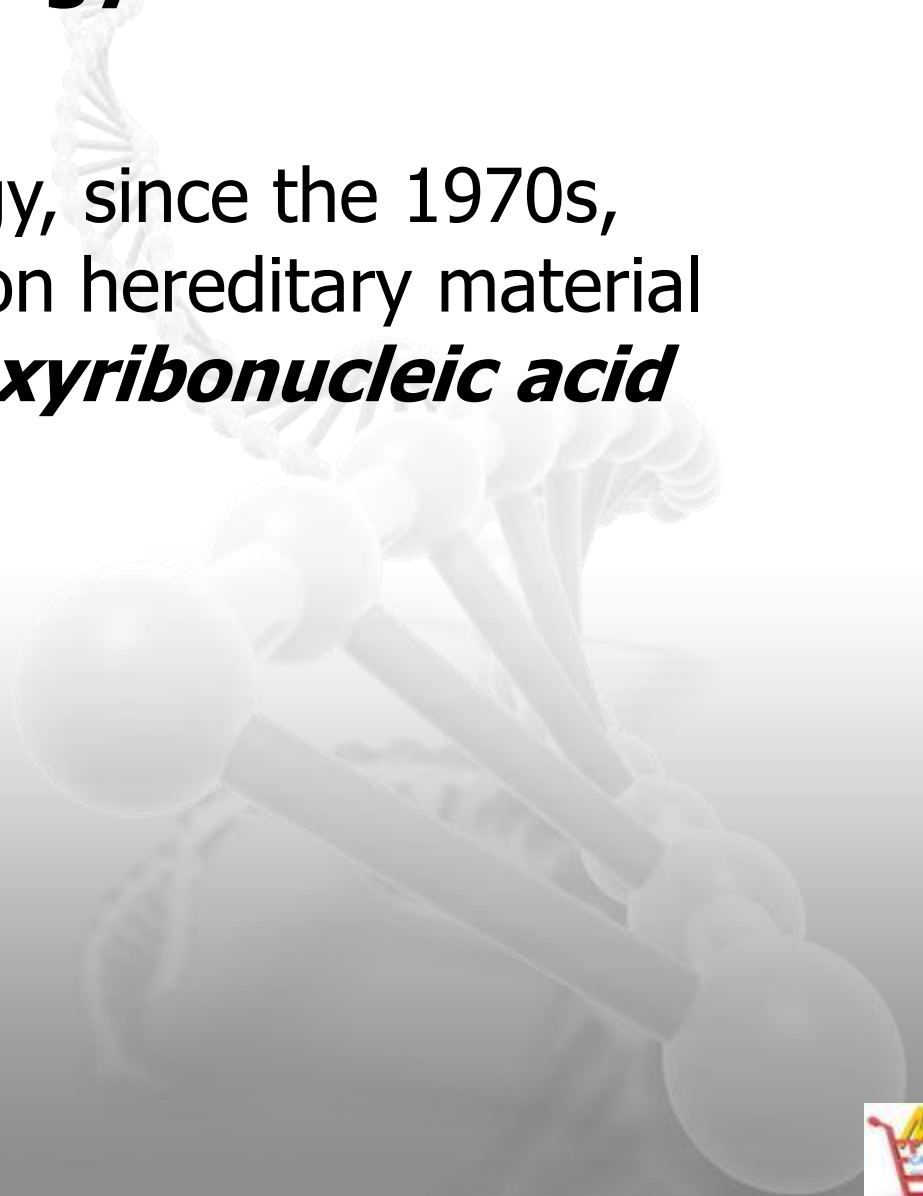
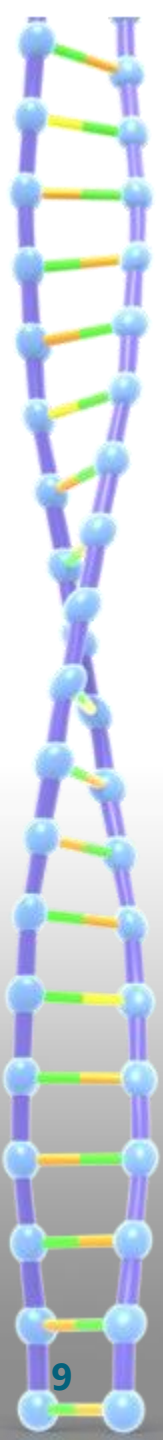
- Often hybrids resulted in sterile offspring, such as seedless watermelons or seedless bananas.
  - ***Sterile*** means an organism is incapable of producing seeds and therefore cannot reproduce.





# What is biotechnology ?

- Modern biotechnology, since the 1970s, centers on the common hereditary material found in all cells, ***deoxyribonucleic acid (DNA)***.



# What is biotechnology ?

- Instead of working with whole organisms, scientists work at the molecular level of cells for research and development of products from plants and animals.



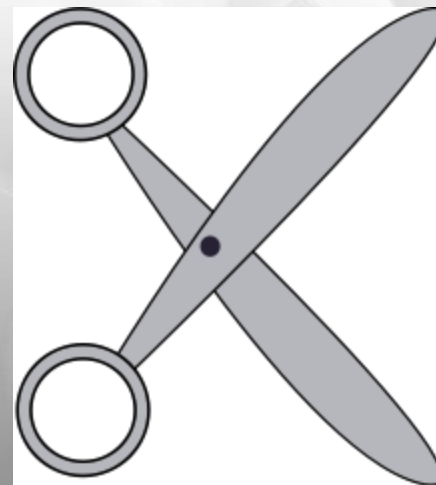
# What is biotechnology ?

- ***Genetic engineering (GE)*** or ***recombinant DNA (rDNA)*** technology, discovered by Cohen and Boyer in 1970, allows scientists to “cut” DNA from one organism and “paste” it into another.



# What is biotechnology ?

- Scientists can find a ***target gene***, a segment of DNA that codes for a desirable trait, and cut out that segment of DNA with molecular scissors called a ***restriction enzyme***.



# What is biotechnology ?

- The target piece of DNA can then be pasted into a ***plasmid***, a circular piece of DNA used as a vector to move the target piece of DNA from one organism to another.
  - Results in ***transgenic organism***



# What is biotechnology ?

- A ***transgenic organism*** is one that contains foreign DNA and expresses a new trait or enhanced characteristic.
  - It is sometimes simply called a transgenic.



# What is biotechnology ?

- The goals of GE or rDNA are still similar to traditional agricultural goals:
  - Better efficiency for growth
  - Better yield
  - Tastiness
  - Improved appearance
  - Resistance to disease
  - Ease of growing
  - Extension of growing seasons

