Introduction to Biotech QQ

MANIPULATING
and
ANALYZING
DNA

QQ#1

- Discuss with the person next to you and then write an answer to the following question:
  - Where in life have you heard of biotechnology being used?

Biotechnology:

- Overall biotechnology involves manipulating and analyzing DNA
- This includes biological processes, organisms, or systems to manufacture products intended to improve the quality of human life.

We will discuss the following uses of Biotechnology

- Crime Scene Investigation
- In Vitro Fertilization and designer babies
- Genetically Modified Organisms
- Cloning
- Therapeutic cloning
- Stem Cell Research

QQ#2

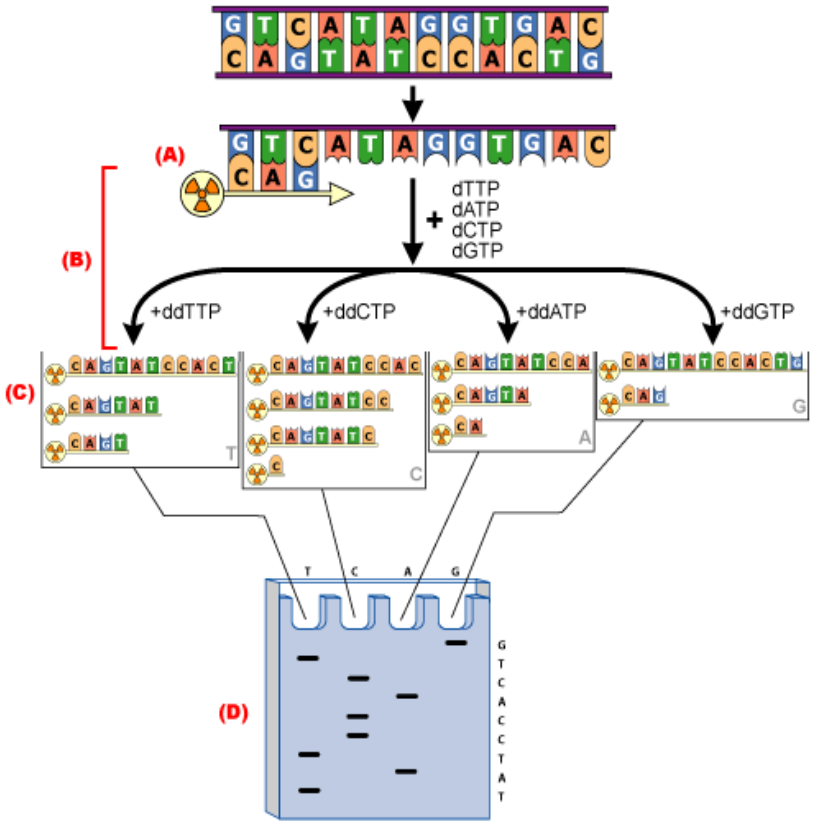
- What do you think genetic engineering is? How does it relate to biotechnology?

Genetic Engineering

- One of the most common tools in biotechnology is the use of genetic engineering

- Definition: The technology including all processes of altering the genetic material of a cell to make it capable of performing desired functions, such as producing novel substances

To complete any genetic engineering, you must…



- DNA Sequencing: reading or identifying the sequence of bases along the length of a DNA molecule AND understanding what that sequence codes for…

The basic tools of genetic engineering

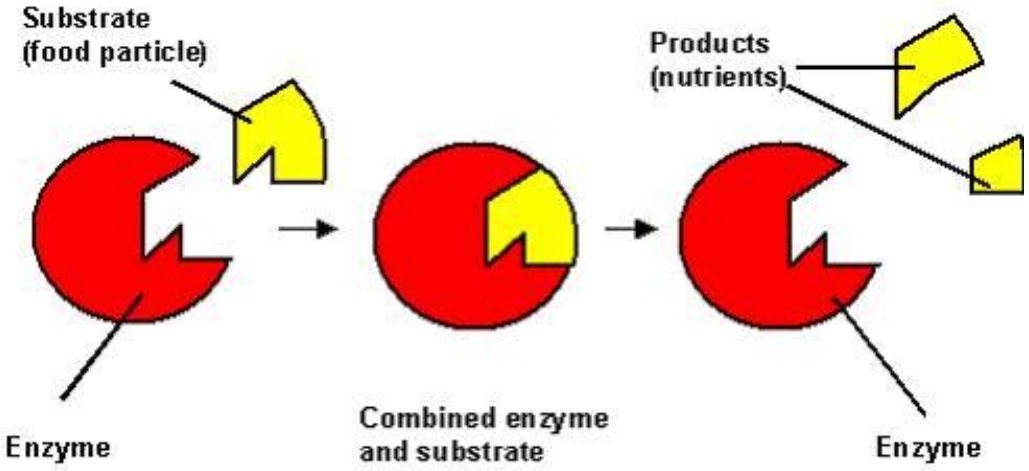
1. restriction enzymes
2. plasmids
3. recombinant DNA
4. transformation

QQ#3

- Let's review:
  - What are enzymes? How do they function?

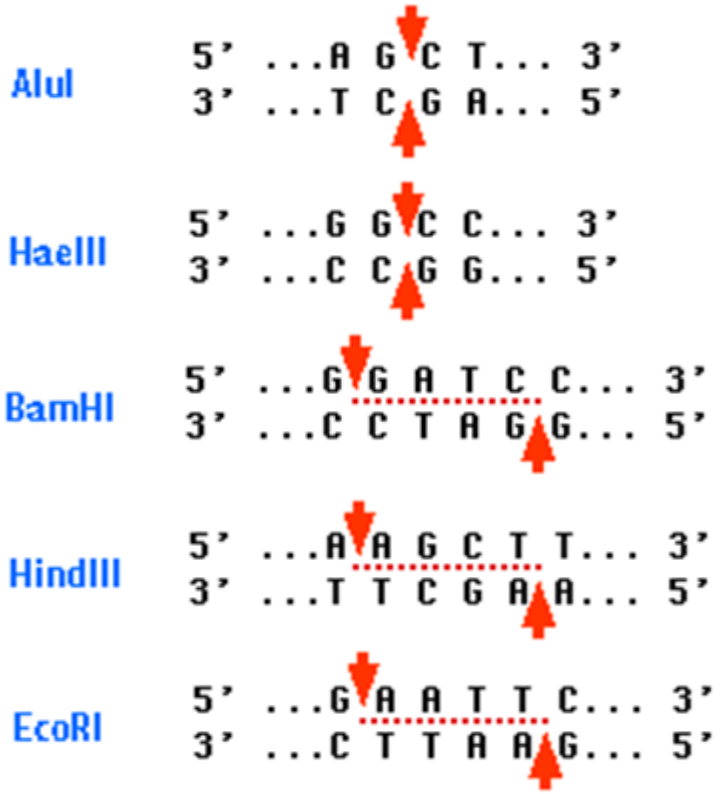
Recall…

- What defines function of a protein?
  - SHAPE DEFINES FUNCTION!!
- The most major class of proteins are enzymes
- Enzymes work like pieces of a puzzle…each is specifically shaped for whatever molecule it acts on



How enzymes break down food into nutrients

Tool #1: Restriction Enzymes



Which will produce blunt ends and which will produce sticky ends?

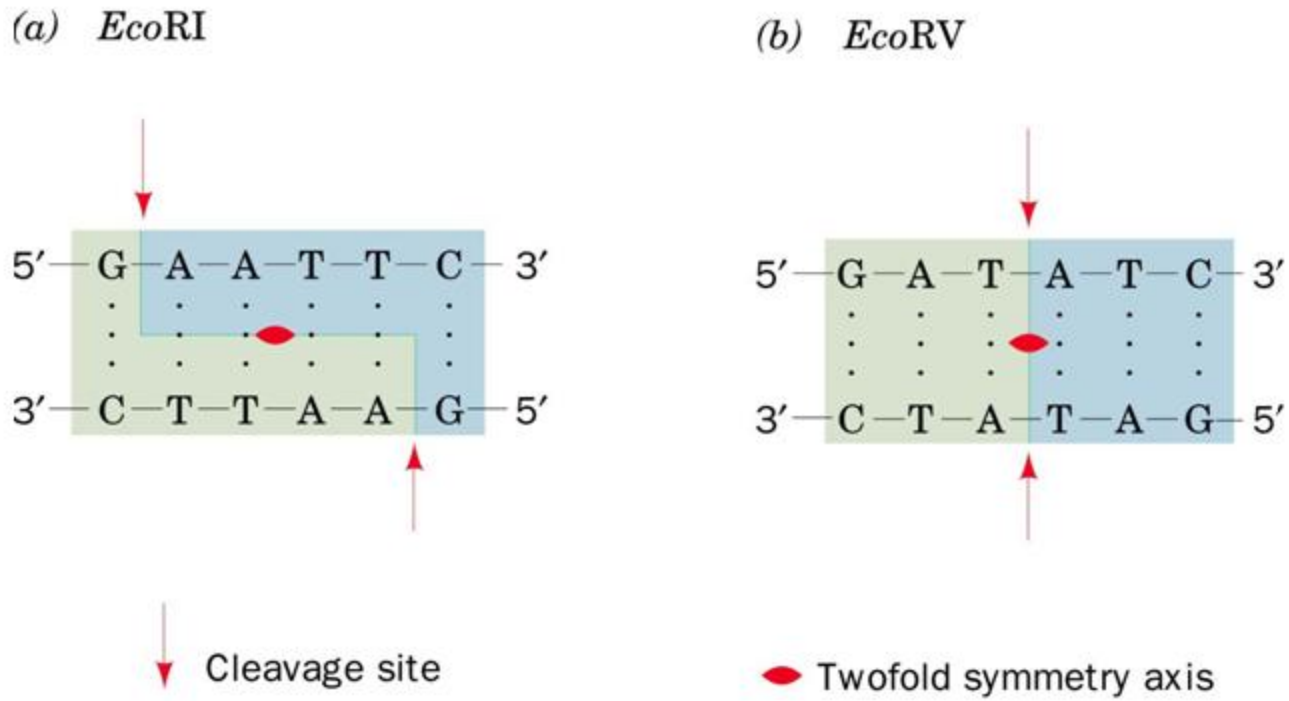
- Enzymes originally found in bacteria that protected against viruses
- RE's chop DNA at specific sequences called *recognition sites*

AluI and HaeIII produce blunt ends

BamHI HindIII and EcoRI produce "sticky" ends

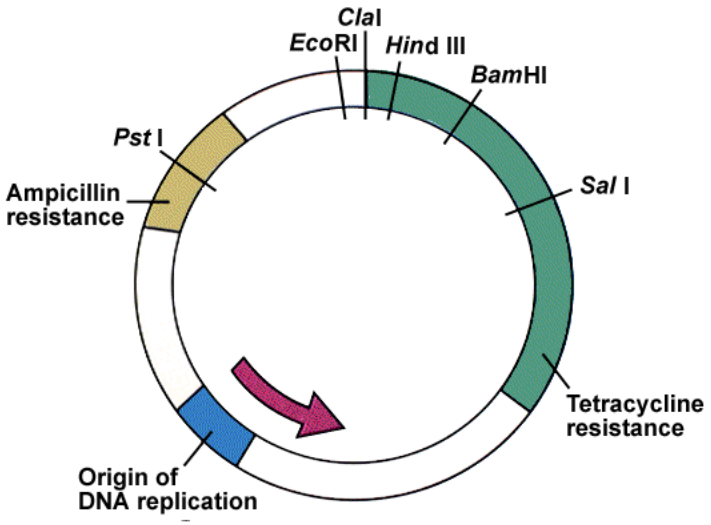
The "Ends"

- Two types of RE cuts…
  - "Sticky" ends leave exposed bases ready to hydrogen bond
  - "Blunt" ends leave NO bases exposed
- DNA ligase joins "the ends" of cut DNA together



Tool #2: Plasmids

- Circular double-stranded DNA (bacterial)
- Used in biotechnology because:
  - often have multiple recognition sites
  - replicate on their own
  - Small
  - Have genetic markers
- Used to create recombinant DNA



Tool #3: DNA Recombination

- DNA fragments that code for desired traits + bacterial plasmid = Recombinant DNA
- Using restriction enzymes, scientists extract the desired DNA from an organism and cut a plasmid and insert that DNA.
- Recombinant DNA cannot function all by itself
- They must become a part of the genetic material of LIVING cells before the genes they contain can be activated

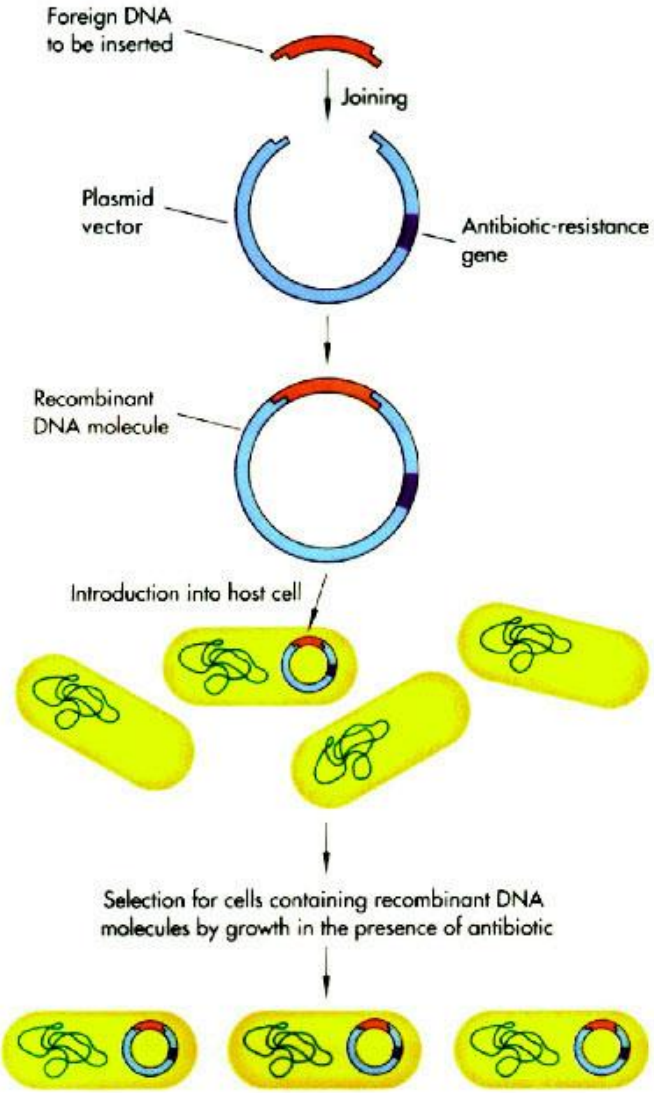
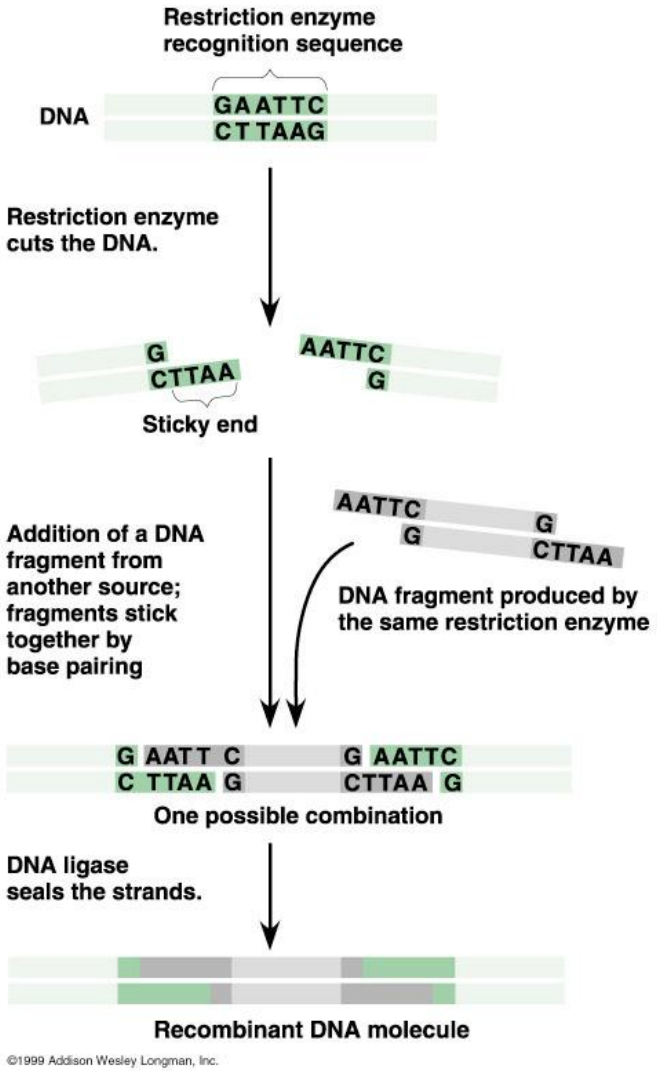


FIGURE 5-11
The cloning of DNA in a plasmid.



QQ#4

- Compare and contrast recombinant DNA and plasmids

Tool #4: Transformation

- Transformation is the process in which recombinant DNA is added into a living cell
- The living cell (usually a bacteria cell) will the express the new DNA

Putting it all together:

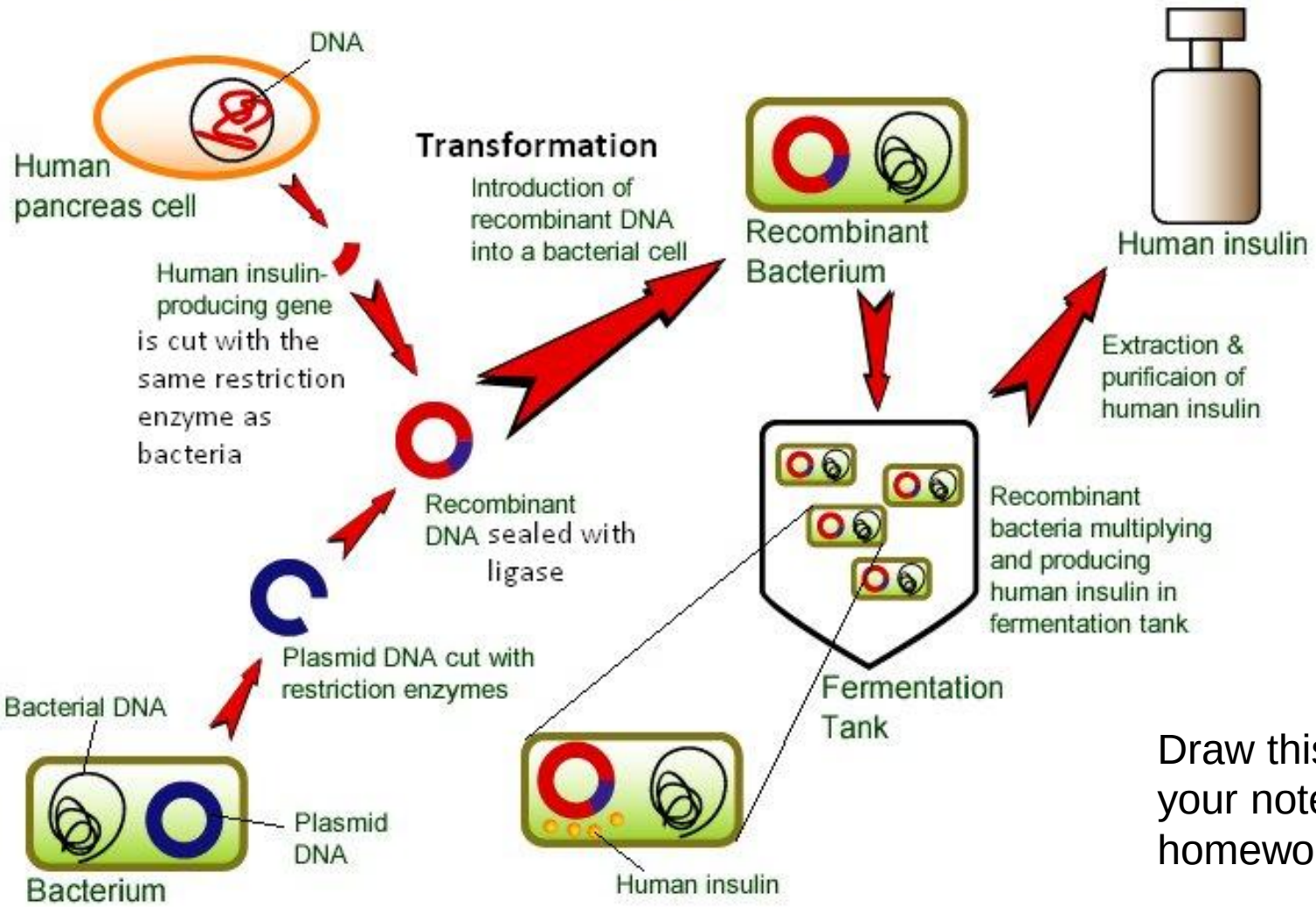
Creating Functioning Recombinant DNA

Steps: using insulin (for sufferers of diabetes) as an example

1. Cut open **plasmid** and **DNA with gene encoding for insulin** with same RE
2. Mix cut **plasmid** with cut **DNA** (they have the same *sticky* ends)
3. Seal with **ligase**
4. Transformation: Insert recombinant DNA into bacteria
5. Recombinant DNA replicates and bacteria divides
6. DNA is transcribed and translated = insulin

Putting it all together:

Human Insulin Production



Draw this in your notes for homework!

QQ#5

- Working with the person next to you, write a summary of how the following are related: restriction enzymes, plasmids, recombinant DNA and transformation