

DNA Technology

Chapter 20


Concepts 20.1 and 20.5

I. Biotechnology throughout the Ages


Biotechnology - manipulating living organisms to do practical tasks or produce useful products.

- Microorganisms used to produce wine and cheese.
- Selective breeding of livestock and crop plants.
- Genetic engineering-

Domestication



Genetic Engineering

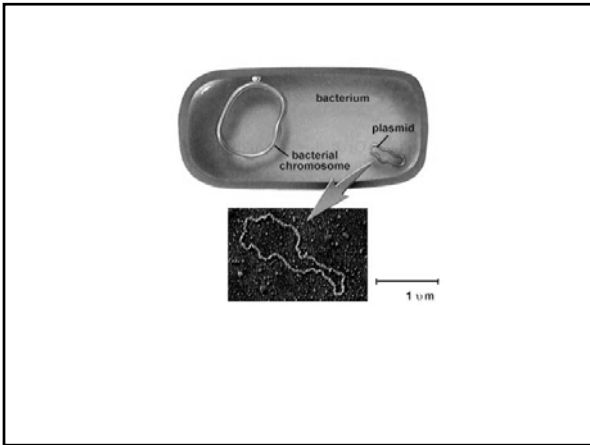


"Golden Rice" contains B-carotene

II. Genetic Engineering in Bacteria

A. Plasmids from *E. coli* are used to "clone" genes of interest.

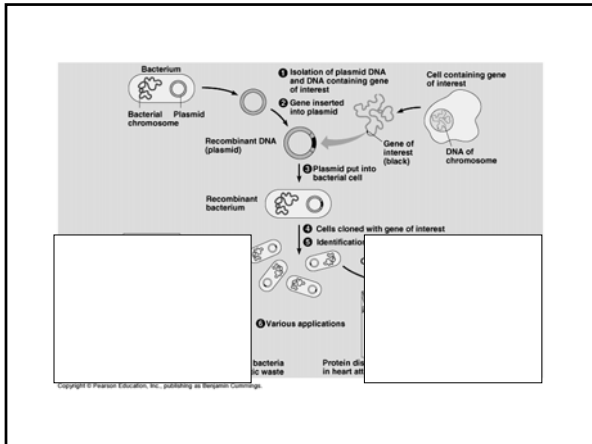
1. Plasmid DNA vs. chromosomal DNA
2. plasmids occur in nature



II. Genetic Engineering in Bacteria (*E. coli*)

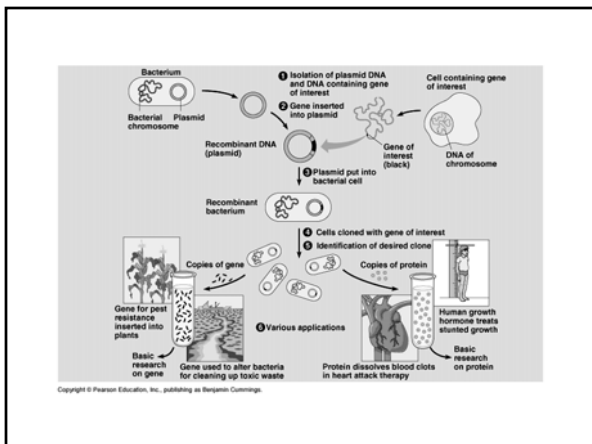
B. Steps in Gene Cloning

1. Gene of interest is inserted into a plasmid (in vitro)
2. Recombinant plasmid (plasmid + gene) is returned to *E. coli*.
3. The gene of interest is "cloned" (copied) in *E. coli* through multiple rounds of DNA replication and cell division.



II. Genetic Engineering in Bacteria

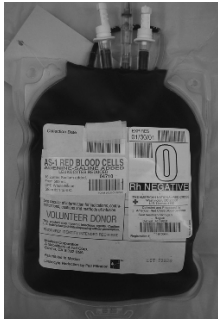
What can you do with millions of copies of your gene of interest in *E. coli*?



III. Gene expression in *E. coli*

- A.
- B.

Hemophilia and Susceptibility to HIV



Human Factor VIII is now produced in *E. coli* through genetic engineering.

Diabetes



Now the human form of insulin is made in *E. coli* using genetic engineering

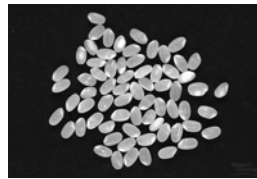
IV. Transfer of the foreign gene from *E. coli* to other organisms

-
- insect-resistant plants (BT toxin)
- Golden Rice

BT Toxin kills Tobacco Horn Worm
And other Lepidoptera Insects



Golden Rice w/ B-Carotene



IV. Transfer of the foreign gene from *E. coli* to other organisms

Gene Therapy in Humans:

- ADA deficiency (nonfunctioning immune system)
- OTC deficiency (ammonia buildup in bloodstream)
- Factor VIII deficiency (hemophilia)

**Adenine Deaminase (ADA)
Deficiency**



Commonly referred to a "bubble boy" disease, SCID, gets its moniker from David Vetter, a boy who lived out his 12 years of life in a germ-free plastic bubble.

**Ornithine Transcarbamylase (OTC)
Deficiency and Jessie Gelsinger**