SNS COLLEGE OF ENGINEERING

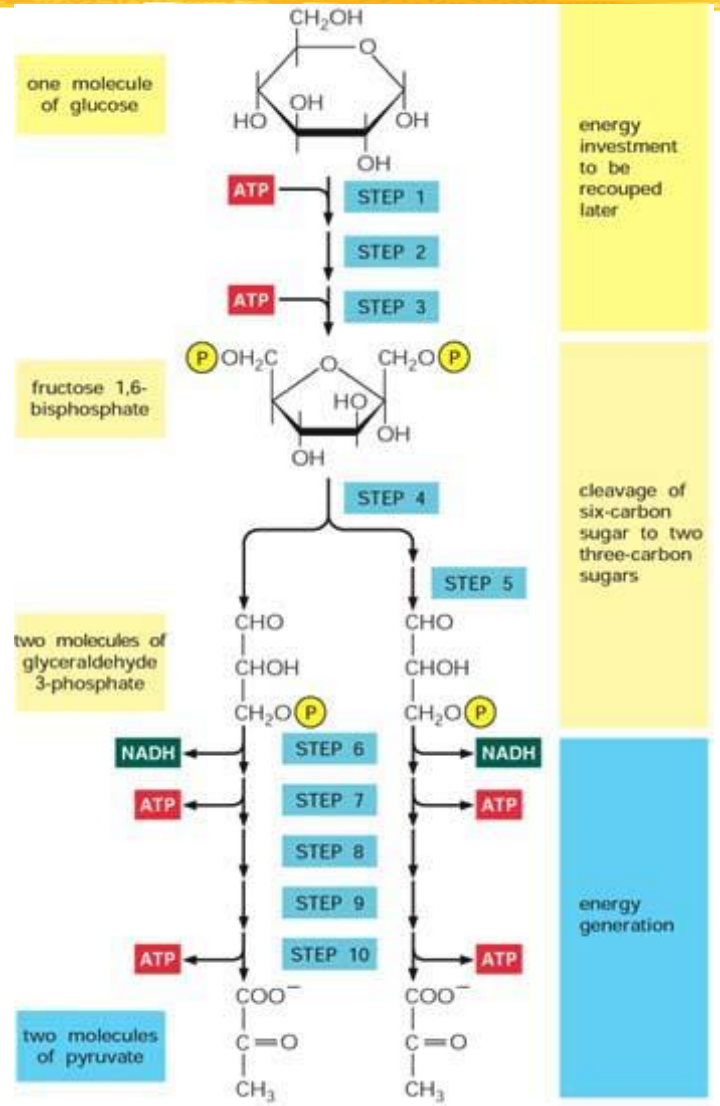
(An Autonomous Institution)
COIMBATORE-107
Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

19GET277 / Biology For Engineers
IV YEAR / VII SEMESTER
UNIT-II: BIODIVERSITY

ECONOMIC IMPORTANCE AND CONTROL OF MICROBES

Using Microbes for a Variety of Everyday Applications

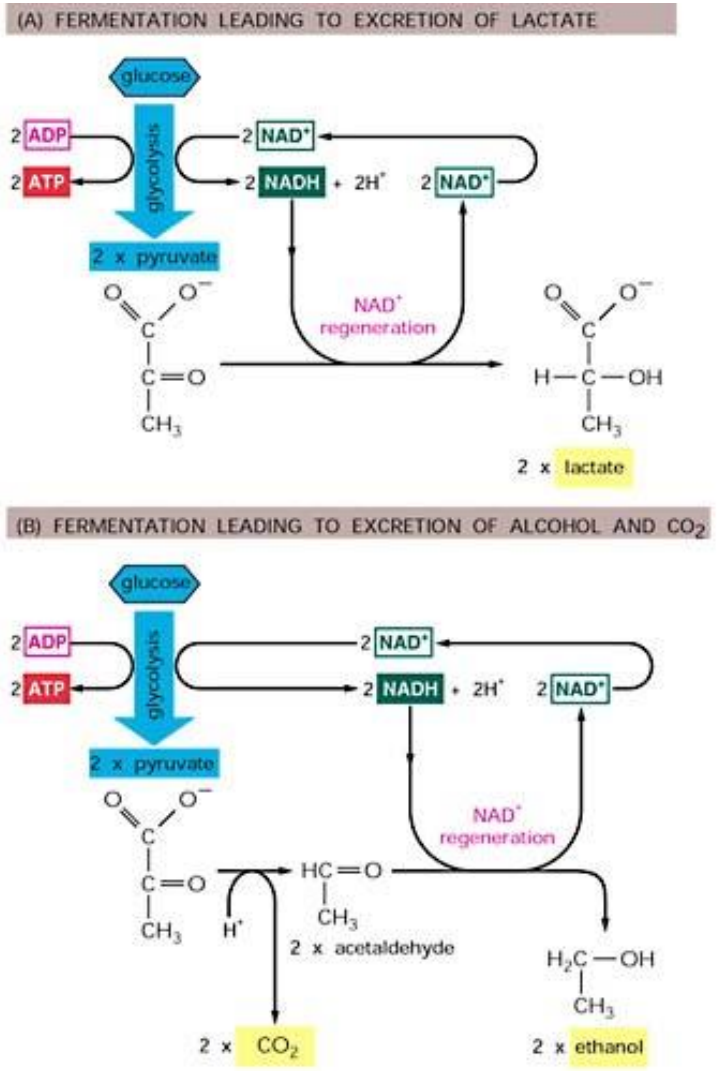
- Food Products
  - Energy production in bacteria
    - Aerobic or anaerobic



Using Microbes for a Variety of Everyday Applications

- Food Products
  - Fermentation

    (anaerobic respiration)
  - Lactic acid fermentation
    - Used to make cheese, yogurt, etc.
  - Ethanol fermentation
    - Used to make beer and wine

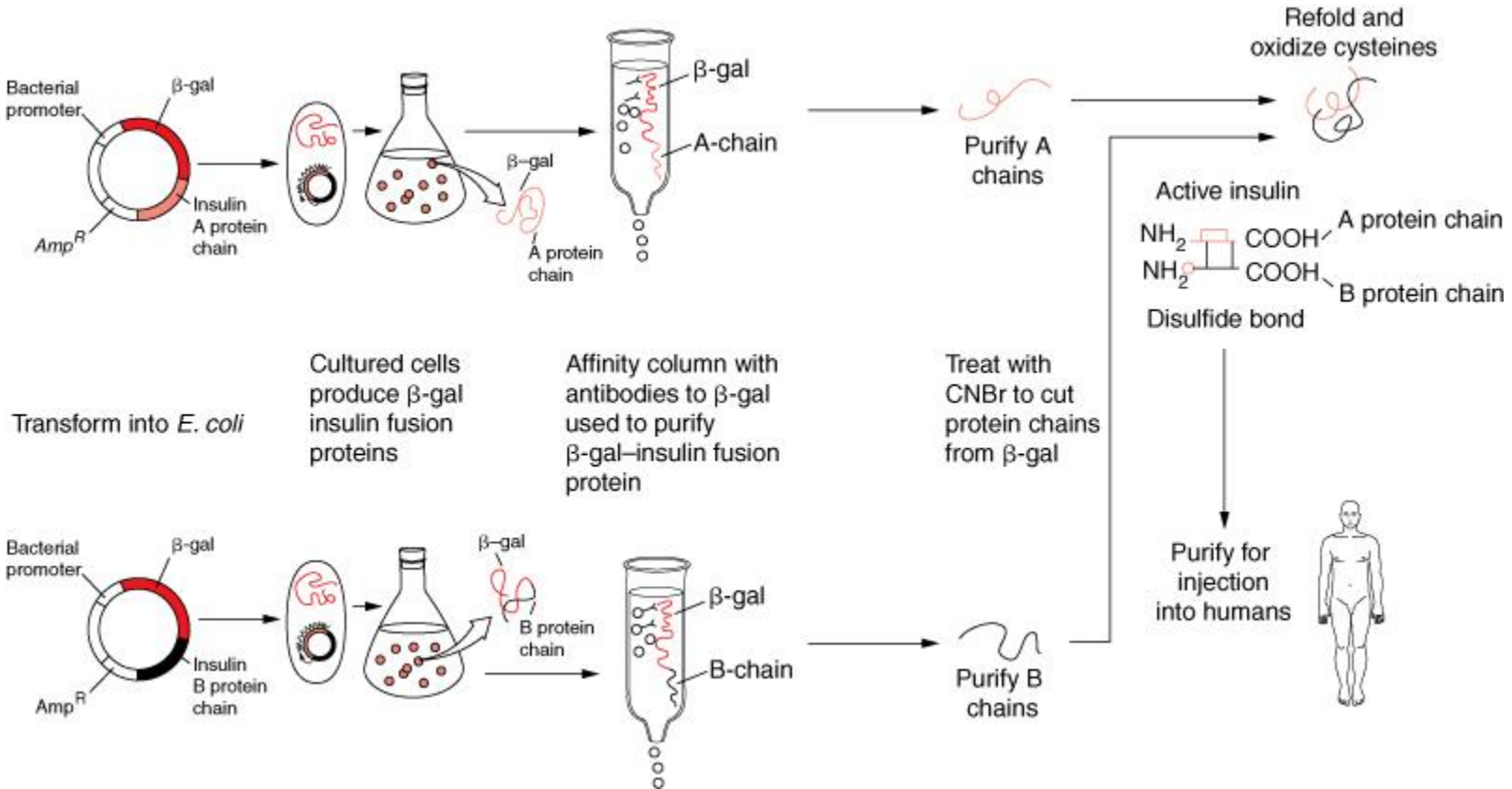


Using Microbes for a Variety of Everyday Applications

- Field Applications of Recombinant Microorganisms
  - Ice-minus bacteria (remove ice protein producing genes from *P. syringae*)
  - *P. fluorescens* containing the gene that codes for the bacterial toxin from *Bacillus thuringiensis (*kills insects) Bt toxin!

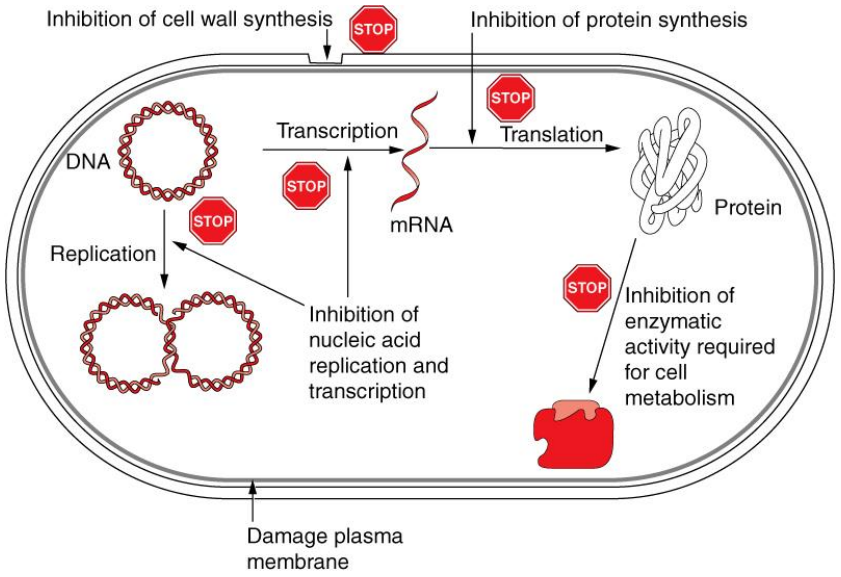
Using Microbes for a Variety of Everyday Applications

- Therapeutic proteins
  - Recombinant insulin in bacteria



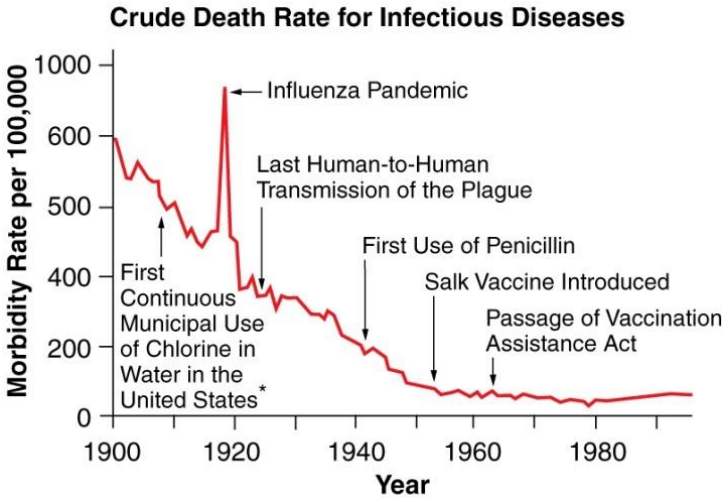
Using Microbes for a Variety of Everyday Applications

- Using Microbes Against Other Microbes
  - Antibiotics
  - Act in a few key ways
    - Prevent replication
    - Kill directly
    - Damage cell wall or prevent its synthesis



Vaccines

- First was a vaccine against smallpox (cowpox provides immunity)
  - DPT-diphtheria, pertussis, and tetanus
  - MMR –measles, mumps, and rubella
  - OPV- oral polio vaccine (Sabin)

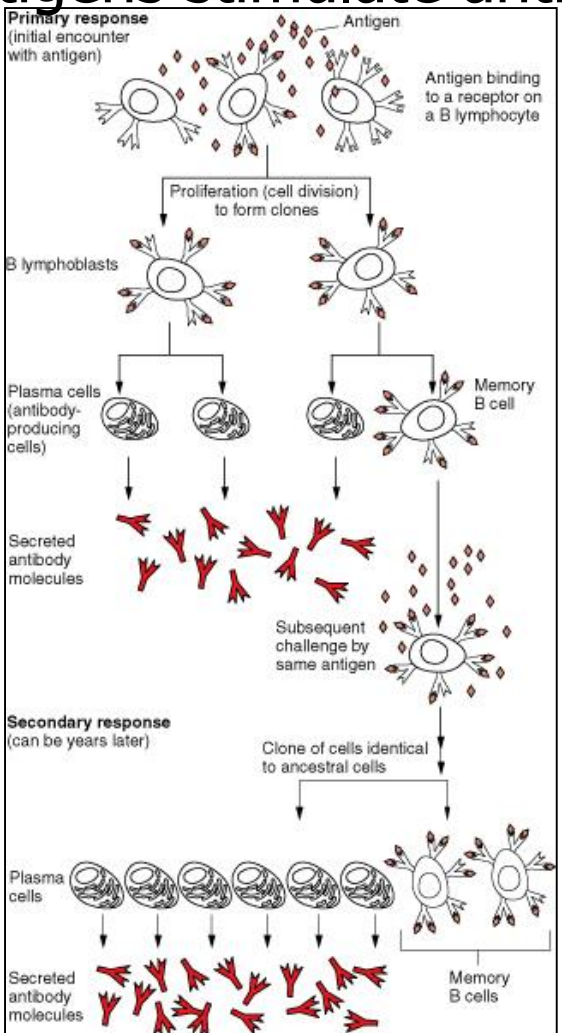


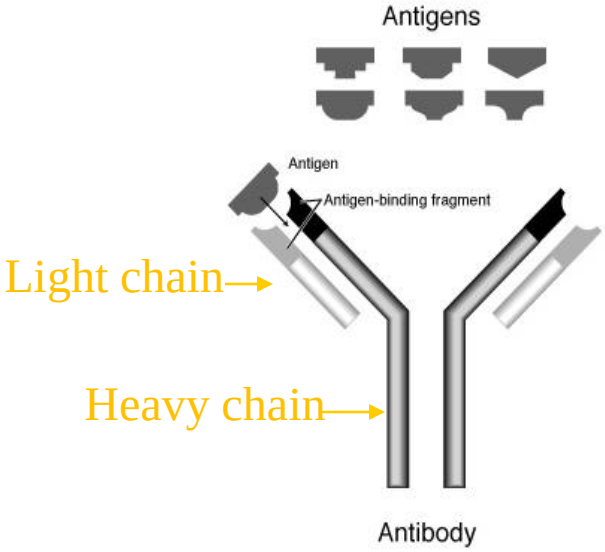
Vaccines

- A Primer on Antibodies
  - Antigen- foreign substances that stimulate an immune response
  - Types of leukocytes or white blood cells
    - B-lymphocytes: antibody-mediated immunity
    - T-lymphocytes: cellular immunity
    - Macrophages: “cell eating” (phagocytosis)

Vaccines

- Antigens stimulate antibody production in the immune system



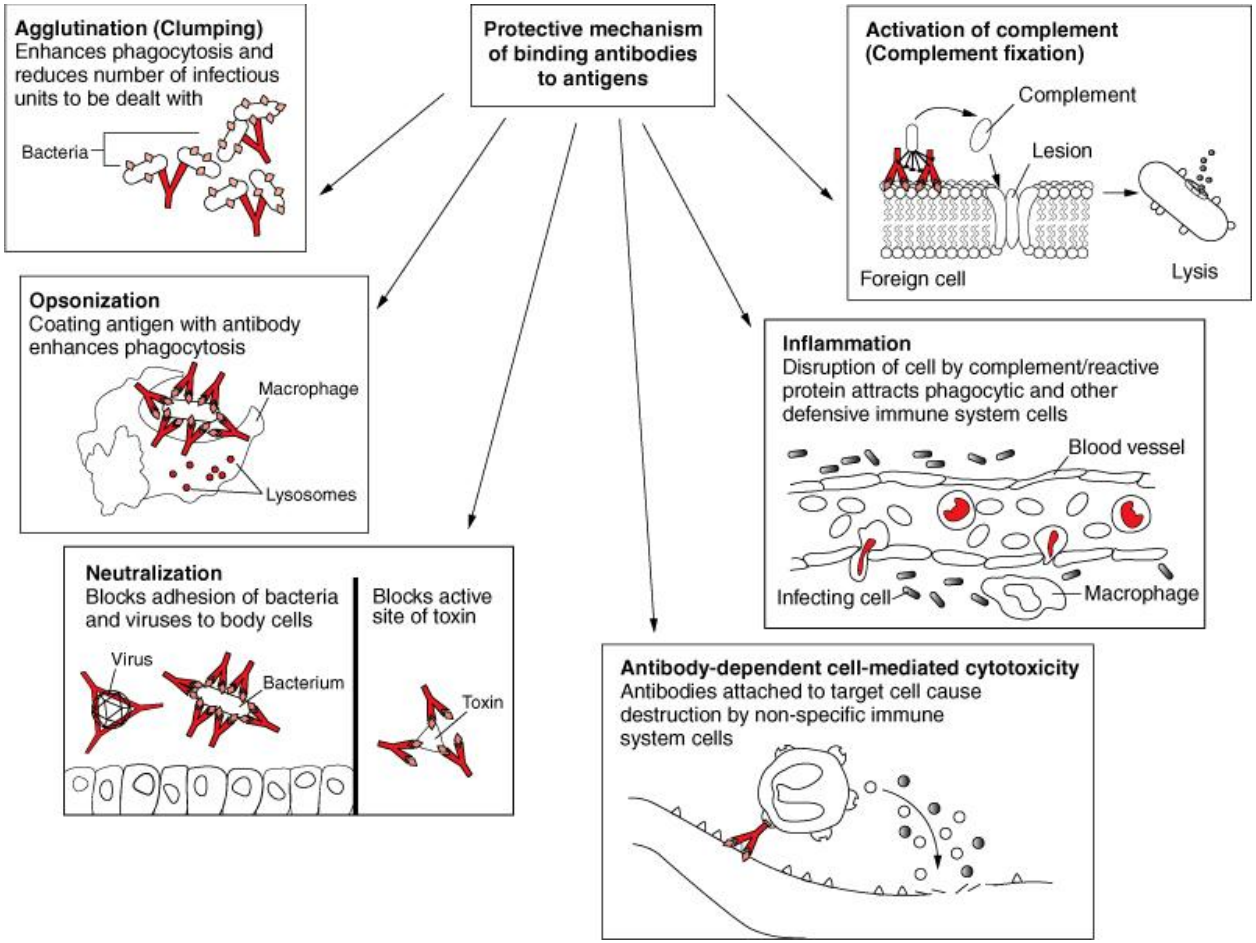


IgA – first line of defense

IgG and IgM – activates macrophages

Vaccines

- Mechanism of Antibody Action



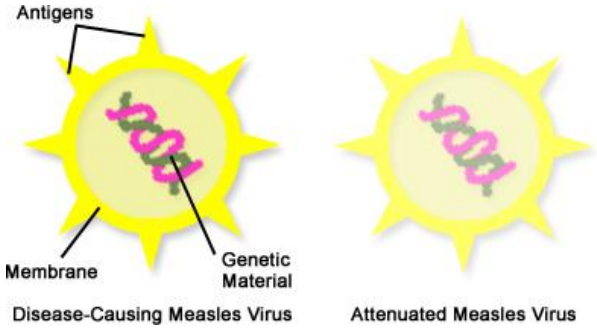
Vaccines

- How are vaccines made?
  - They can be part of a pathogen (e.g. a toxin) or whole organism that is dead or alive but attenuated (doesn't cause disease)
    - Subunit (toxin) or another part of the pathogen
    - Attenuated (doesn't cause disease)
    - Inactivated (killed)
- What about flu vaccines (why do we have to get a shot every year?)

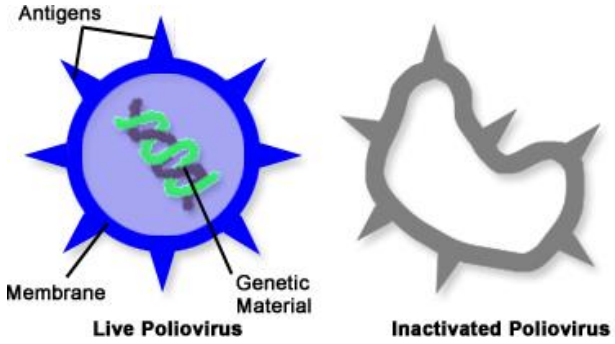
Recombinant Vaccines

- Vaccines – provide immunity to infectious microorganisms

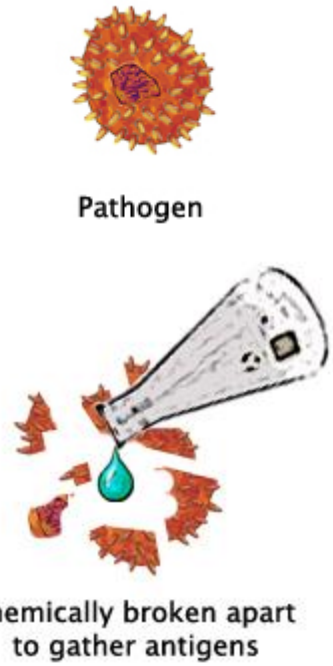
Attenuated Vaccine



Inactivated Vaccine

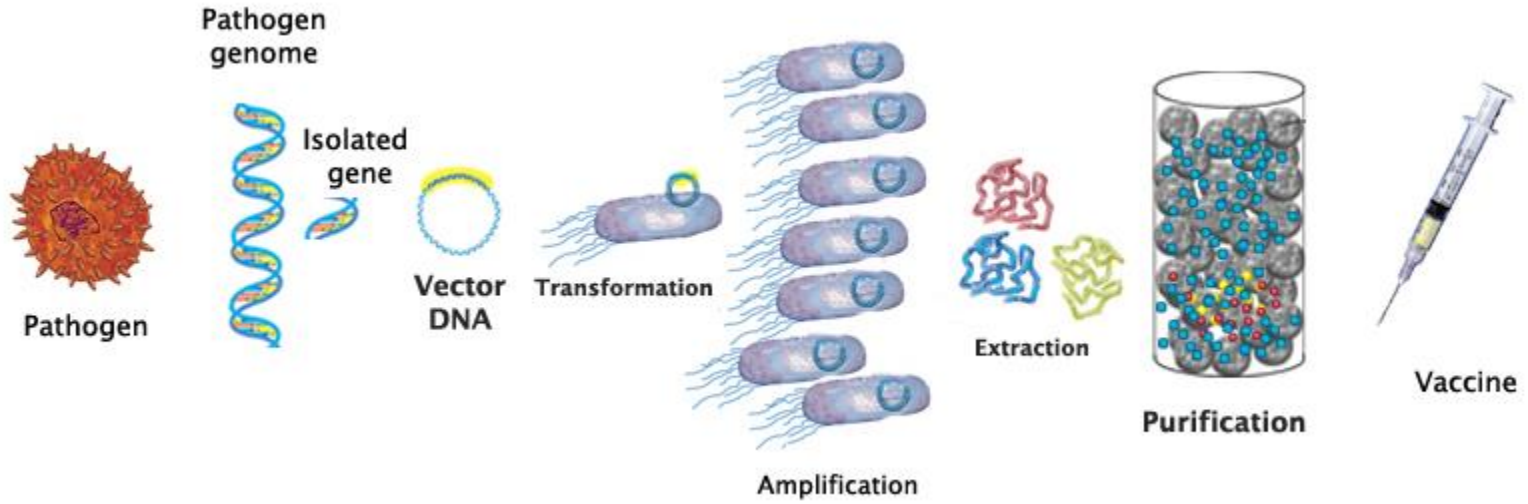


Subunit Vaccine



Recombinant Vaccines

- Recombinant Vaccines
  - A vaccine produced from a cloned gene



Video: Constructing Vaccines

Recombinant Vaccines

- DNA vaccines
  - Direct injection of plasmid DNA containing genes encoding specific antigenic proteins