How do Vaccines Work?

They mimic the _____ and stimulate the _____ to build up defenses against them

- Disease agents' could be a live pathogen or parts of the pathogen known as _____
- Main parts of the' immune system': White Blood Cells (_____) and _____

Vaccination is one way that an individual becomes protected against a disease-causing pathogen

- Immunization is used interchangeably with Vaccination

Immunization

Two kinds of Immunization:

_____

- Can be achieved by injecting a recipient with preformed antibodies from immune individuals
- Naturally occurs when antibodies are passed from mother to fetus

_____

- Can be achieved by natural infection with a microorganism or acquired artificially by giving a _____
- Stimulation of antigen-specific T and B cells (immune system is active)
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Types of Vaccines:

1. Live, Attenuated (a.k.a. weakened) Vaccines
    1. A Pathogenic bacterium or virus is grown for prolonged periods under abnormal conditions than in natural host
    2. Select for mutants that are better suited for growth in the abnormal culture conditions than in the natural host.

- Inoculation of humans with cowpox virus gives immunity to small pox
- Mycobacterium bovis strain (BCG) adapted to growth in strong bile until it was weakened enough to be a suitable vaccine for Tuberculosis

2. Inactivated or "Killed" vaccines

   The pathogen is treated with heat or chemicals and _____ so that it is incapable of _____. The structure of the surface antigens has to be maintained by the heat/chemical treatment.

- The Salt polio vaccine is produced by formaldehyde inactivation of the poliovirus

3. Subunit Vaccines

Specific, purified macromolecules are derived from the pathogen. These are antigenic parts which can elicit a protective immune response.

The three most common available subunit vaccines are:

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Toxoid Vaccines

The exotoxins that bacteria use to produce disease in their host is inactivated using heat/chemicals.

- Tetanus, Di[htheria bacterial vaccines

Capsular polysaccharides

Involves injecting the host with the same molecule that makes up a bacterium's polysaccharide capsule which then initiates the formation of antibodies.

- Current vaccine for Streptococcus pneumoniae has 13 antigenically distinct capsular polysaccharides.
- The vaccine for Neisseria meningitidis, a common cause of bacterial meningitis

4. Recombinant Vector Vaccines

Individual genes that encode key antigens of a pathogen are introduced into weakened viruses or bacteria. The attenuated organism acts as a vector that replicates in the host but expresses the gene product of the pathogen.

- Yellow fever vaccine engineered to express the antigens of West Nile Virus

5. DNA Vaccines

Uses plasmid DNA that code for antigenic proteins that are injected directly into the muscle of the recipient. The DNA can be integrated into chromosomal DNA or kept apart.

- Human trials underway for malaria, HIV, Ebola