VACCINATION

- Portrait of Edward Jenner

- Painting of the first vaccination, 1768.

Kinds of immunopreperarates

1. **Live vaccines .** Live vaccines prepared from attenuated vaccine strains of microorganisms are more effective than inactivated chemical vaccines.
2. **Inactivated vaccines** are prepared from highly virulent strains with adequate antigen properties.

- *Chemical vaccines* These are specific antigens extracted chemically from microbial cells.
- *Toxoids* are formaldehyde-treated exotoxins of the microorganisms causing diphtheria, tetanus, cholera, botulism, and other diseases.

Bacille Calmette-Guerin, BCG

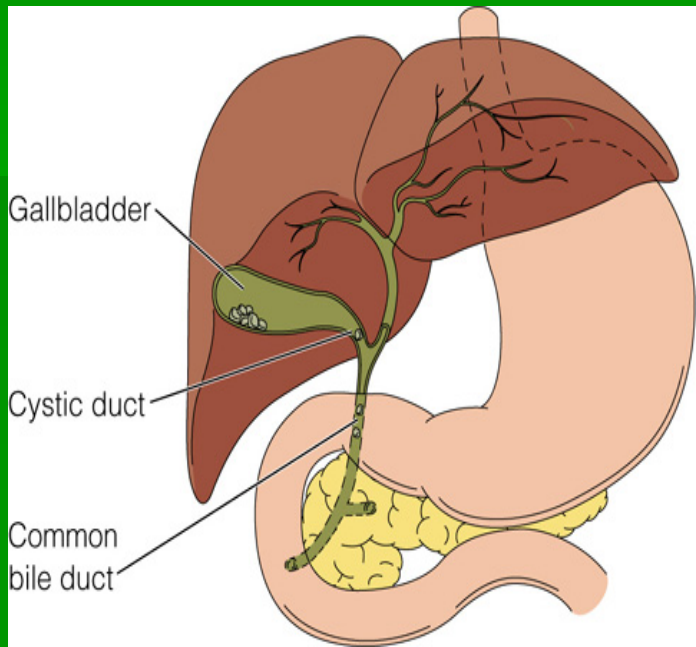
- BCG is a vaccine against tuberculosis that is prepared from a strain of the attenuated (weakened) live bovine tuberculosis bacillus, Mycobacterium bovis, that has lost its virulence in humans by being specially cultured in an artificial medium for years. The bacilli have retained enough strong antigenicity to become a somewhat effective vaccine for the prevention of human tuberculosis. At best, the BCG vaccine is 80% effective in preventing tuberculosis for a duration of 15 years, however, its protective effect appears to vary according to geography.

Method of administration of BCG

- BCG is given as a single intradermal injection at the insertion of the deltoid. If BCG is accidentally given subcutaneously, then a local abscess may form.

What is hepatitis B ?

- Certain activities increase your chances of being infected with hepatitis B virus (such as intravenous drug use, tattooing, or sex with people who are infected). However, it is possible to catch hepatitis B virus even through casual contact (for example, sharing washcloths or toothbrushes) with someone who is infected! Because many people who are infected don't know that they are infected, it is very hard to avoid the chance of getting infected with hepatitis B virus.



Hepatitis B Vaccine

- The hepatitis B vaccine is given to prevent the severe liver disease that can develop when children or adults are infected with hepatitis B virus. The hepatitis B vaccine is given as a series of **three shots**. The first dose is given between birth and 2 months of age. The second dose is given one to two months after the first dose. The third dose is given between 6 months and 18 months of age.

What is hepatitis B virus?

- Hepatitis B virus attacks the liver. Hepatitis B virus infections are known as the "silent epidemic" because many infected people don't experience symptoms until decades later when they develop hepatitis (inflammation of the liver), cirrhosis (severe liver disease), or cancer of the liver (hepatocellular carcinoma).
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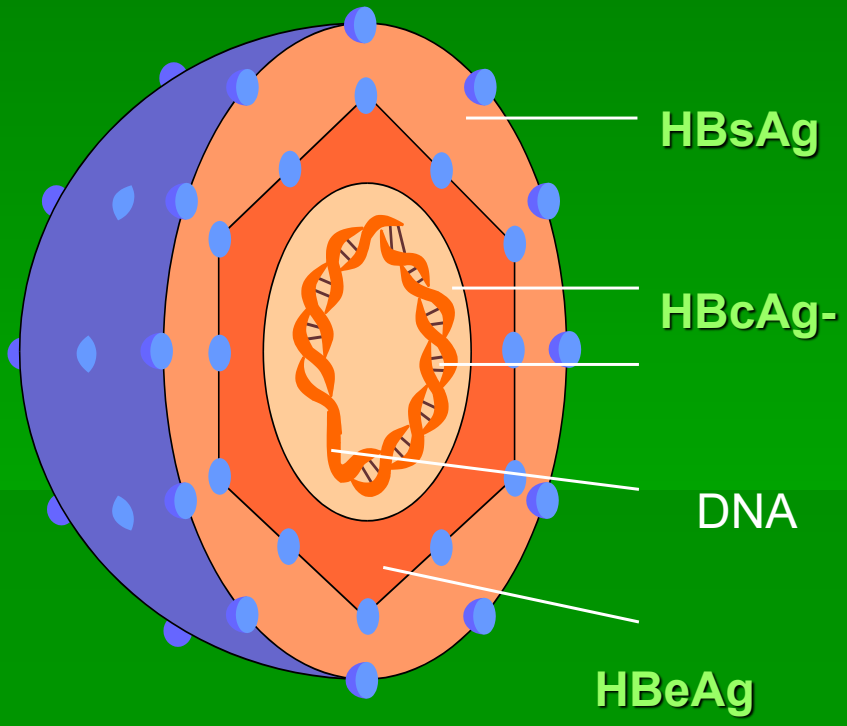

How is the hepatitis B vaccine made?

- Today, the surface protein (HBsAg) is manufactured in the laboratory, so there is no risk of contaminating the vaccine with other viruses that might be found in blood, such as HIV. (Although contamination with HIV was a theoretical risk of the early, blood-derived, hepatitis B vaccine, no one ever got HIV from the hepatitis B vaccine. That is because the blood used to make vaccine was submitted to a series of chemical and physical treatments that inactivated any possible contaminating virus). The hepatitis B vaccine is now made by taking the part of the virus that makes surface protein ("surface protein gene") and putting it into yeast cells. The yeast cells are then instructed to make surface protein by the viral gene.

Diphtheria vaccine

- The diphtheria vaccine is contained in a preparation called "DTaP" (the "D" in DTaP stands for diphtheria). DTaP vaccine is given as a series of five shots, at 2 months, 4 months, 6 months, 15 to 18 months, and again at 4 to 6 years of age.

What is diphtheria?

- The dangers associated with diphtheria come from the toxin released by the bacterium, Corynebacterium diphtheriae. The toxin makes it difficult for children to breathe and swallow, but it also attacks the heart, kidneys and nerves.

Available Vaccines

- No diphtheria-only vaccine is available. The diphtheria vaccine is available as:
- DTaP (Diphtheria-Tetanus-acellular Pertussis vaccine)
- DTaP in combination with Haemophilus influenzae type b (Hib) vaccine
- DTaP in combination with hepatitis B and inactivated polio vaccines
- DT or Td (in combination with tetanus vaccine)
- Tdap (Diphtheria-Tetanus-Pertussis)

How is the diphtheria vaccine made?

- The bacteria that causes diphtheria makes a harmful protein, called a toxin. People who develop an immune response to this toxin are protected against the disease. The diphtheria vaccine is made by taking the diphtheria toxin and inactivating it with a chemical. The inactivated toxin is called a "toxoid." Once injected, the toxoid causes an immune response to the toxin, but, unlike the toxin, doesn't cause disease.

What are the side effects of the diphtheria vaccine?

- The diphtheria vaccine can cause mild side effects such as pain or soreness in the local area of the shot and occasionally a low-grade fever.

Tetanus vaccine

- The tetanus vaccine is contained in a preparation called DTaP (the "T" in DTaP stands for tetanus). DTaP vaccine is given as a series of five shots, at 2 months, 4 months, 6 months, 15 to 18 months, and again at 4 to 6 years of age.

What is tetanus?

- Tetanus is another disease caused by a toxin-releasing bacterium, *Clostridium tetani*. Unlike most vaccine- preventable diseases, tetanus is not a disease that you catch from someone else. The bacteria live in the soil and usually enter the body following a puncture wound of the skin. Items likely to be contaminated with the tetanus bacteria include nails or pieces of glass that were lying on the ground. Once under the skin, the bacteria make a toxin that causes muscle spasms. If these spasms affect the throat and jaw (lockjaw), they can interfere with breathing, causing suffocation. The tetanus toxin can also damage the heart.

  Given the playful, adventurous, and oftentimes injury-prone nature of children, it's important to immunize them against tetanus. Hand washing and bathing do little once the bacteria actually get under the skin.

How is the tetanus vaccine made?

- The bacteria that causes tetanus makes a harmful protein, called a toxin. The name of the tetanus toxin is tetanospasmin. People who develop an immune response to this toxin are protected against disease. The tetanus vaccine is made by taking the tetanus toxin and inactivating it with a chemical. The inactivated toxin is called a "toxoid." Once injected, the toxoid elicits an immune response against the toxin, but, unlike the toxin, doesn't cause disease.

What are the side effects of the tetanus vaccine?

- Like the diphtheria vaccine, the tetanus vaccine can cause mild side effects such as pain or soreness in the local area of the shot and occasionally a low-grade fever.
- The tetanus vaccine is also a very rare cause of a severe allergic reaction. It is estimated that this allergic reaction could occur in as many as one of every million children who receive the vaccine. This allergic reaction includes hives, difficulty breathing, or a lower blood pressure and occurs within 15 to 30 minutes of receiving the vaccine. The allergic reaction can be treated with medications.

Should teenagers and adults get the tetanus vaccine?

- Every 10 years, people should receive the tetanus and diphtheria vaccines. Since most children complete their initial series of diphtheria and tetanus vaccines (given as part of the combination vaccine called DTaP) by 4-6 years of age, the next booster dose occurs during adolescence.

Pertussis vaccine

- The pertussis vaccine is contained in a preparation called DTaP (the "P" in DTaP stands for pertussis). DTaP vaccine is given as a series of five shots, at 2 months, 4 months, 6 months, 15 to 18 months, and again at 4 to 6 years of age.

What is pertussis?

- Pertussis (widely known as whooping cough) is one of the most contagious diseases around. Caused by a bacterium (*Bordetella pertussis*), whooping cough makes children cough uncontrollably. With the cough so hard and so persistent children oftentimes can't catch their breath. Children make a "whooping" sound when they attempt to breathe in against a windpipe severely narrowed by mucus. Pneumonia or seizures can also develop.

  Pertussis is unusual in that most children catch the disease from adults and not other children. It is estimated that every year in the United States between 600,000 and 900,000 adults and adolescents get pertussis!

How is the pertussis vaccine made?

- The latest version of the pertussis vaccine was released in the fall of 1996. This vaccine is called the "acellular" pertussis vaccine (or aP) and is purer than the old "whole cell" pertussis vaccine. The "old" pertussis vaccine still contained a killed form of the whole pertussis bacteria. Because individual bacteria are sometimes called cells, the "old" pertussis vaccine was called the "whole-cell" vaccine. On the other hand, the new pertussis vaccine takes advantage of advances in protein chemistry and protein purification. Because the whole killed pertussis bacteria are no longer present, the "new" pertussis vaccine is called the "acellular" vaccine.

What is measles?

- Measles is an infectious viral disease that occurs most often in the late winter and spring. It begins with a fever that lasts for a couple of days, followed by a cough, runny nose, and conjunctivitis (pink eye). A rash starts on the face and upper neck, spreads down the back and trunk, then extends to the arms and hands, as well as the legs and feet. After about 5 days, the rash fades the same order in which it appeared.

Measles vaccine

- Measles vaccine became available in 1963. An improved measles vaccine became available in 1968. Combination measles-mumps-rubella (MMR) vaccine became available in 1971. Combination measles-mumps-rubella-varicella (MMRV) vaccine became available in 2005.

Measles vaccine

- Measles vaccine is a live, attenuated (or weakened) strain of the measles virus grown in chick embryo tissue culture. In the United States, it is recommended that it be given as part of the MMR vaccine, which protects against measles, mumps, and rubella (German measles) or the MMRV vaccine (MMR plus varicella (chickenpox) vaccine) when age-appropriate (licensed for use only from age 12 months through age 12 years).

Rubella

- **Rubella** is a viral infection also known as *German measles*. Rubella infection of children causes a mild rash on the face, swelling of glands behind the ear, occasionally a short-lived swelling of small joints (like the joints of the hand), and low-grade fever.
- But rubella is not always a mild infection. Before the rubella vaccine as many as 20,000 babies were born every year with birth defects because of the capacity of rubella virus to infect the unborn child. In fact, if a woman was infected with rubella in the first trimester of her pregnancy, there was about an 85 percent chance that her unborn child would be permanently harmed! Rubella virus causes blindness, deafness, heart defects or mental retardation.

Rubella

Rubella

What is mumps?

- Mumps is a virus, just like measles. The mumps virus usually causes swelling in the salivary or parotid glands, just below the ear, lasting for seven days. The chipmunk-like appearance of people infected with mumps is how mumps got its name

MMR vaccine

- This vaccine is a shot given subcutaneously (in the fatty layer of tissue under the skin).
- Two doses of measles vaccine (given as combination MMR or MMRV when age-appropriate) are recommended for all children and certain adolescents and adults.

MMR vaccine

- The first dose of MMR or MMRV should be given on or after the first birthday; the recommended range is from 12-15 months. A dose given before 12 months of age may not be counted, so the child's medical appointment should be scheduled with this in mind.

MMR vaccine

- The second dose is usually given when the child is 4-6 years old, or before he or she enters kindergarten or first grade. However, the second dose can be given anytime as long as it is at least four weeks after the first dose. MMRV can only be given through age 12 years.

FIGURE 1. Recommended immunization schedule for persons aged 0–6 years — United States, 2008