

TYPES of IMMUNITY

- ✓ **INBORN IMMUNITY** :immunity to certain disease are present at birth
- ✓ **ACQUIRED IMMUNITY**: immunity that is acquired during one's lifetime. There are two types of acquired immunity:
 - **ACTIVE IMMUNITY**:
 - May result from **HAVING THE DISEASE** (having chicken pox once, you generally do not get it again because memory cells produce antibodies to fight a second infection)
 - **VACCINATION** (see explanation below)
 - PASSIVE IMMUNITY** (temporary immunity – because antibodies are BORROWED only last for a month or so)
 - **MATERNAL IMMUNITY**: antibodies from mother enter baby before birth and provide temporary immunity for the newborn. The newborn also receives antibodies from the mother's milk
 - Receiving an **INJECTION OF ANTIBODIES**, For example, if a person is bitten by a snake, you are given antibodies against the venom of the snake – these antibodies were cultured from a snake.

VACCINES (form of active immunity)

- ✓ Made of weakened, dead parts of pathogens that are combined with other materials and injected into an organism in order to stimulate the immune system to react to the pathogen with a specific immune response.

HOW A VACCINE WORKS:

1. obtain a pathogen and kill or weaken it
2. formulate a vaccine that will enable the pathogen to be infected into the organism
3. the body responds to antigens present on the pathogen by making antibodies and WBCs that attack the invader
4. B memory cells specific for the pathogen remain in the body for a long time to continue the protection from future attacks by the pathogen

AIDS (ACQUIRED IMMUNE DEFICIENCY SYNDROME)

- ✓ Caused by **HIV (human Immunodeficiency virus)** which is a retrovirus that contains RNA as its genetic material
- ✓ HIV spreads by direct contact with infected blood or other body fluids
- ✓ HIV is also spread by sharing needles and sexual contact
- ✓ When HIV invades an organism, it attaches to T cells and replicates within these cells
- ✓ Gradually, HIV kills off most of the helper T cells, severely impairing the body's immune system. The individual is now considered to have AIDS. Without a working immune system, the infected person can become deathly ill from even the mildest of infections.

TRANSPLANTS

- ✓ An individual's body cells have protein markers on the surface of their cells that allow the immune system to recognize cells as "self"
- ✓ Organ transplant has marker proteins that are recognized as "nonself"
- ✓ Killer T cells will destroy organ transplants causing rejection
- ✓ To avoid rejection, transplant patients take medication to suppress the immune system, usually for the rest of their lives.

AUTOIMMUNE DISEASES

- ✓ An autoimmune disease develops when the immune system makes a mistake and attacks the body's own cells.
- ✓ Examples of autoimmune diseases are:
 - Juvenile Onset Diabetes**. the immune system attacks the insulin producing cells of the pancreas (islets of Langerhans)

--**Multiple Sclerosis (MS)**: autoimmune disease of the nervous system resulting from the destruction of the myelin sheath that surrounds nerve fibers

ALLERGIES

- ✓ **A rapid immune response to environmental substances that is normally harmless.**
- ✓ Examples of some allergens include certain foods like peanuts, pollen, animals, and chemicals from insect bites.
- ✓ The immune system reacts by releasing **HISTAMINES** which leads to allergy symptoms including sneezing, runny nose, hives, asthma, and rashes
- ✓ Sometimes allergies cause swelling that can be very dangerous, particularly if the throat swells and closes, interfering with the person's ability to breathe.
- ✓ **ANTIHISTAMINES** reduce the effects of histamines and the symptoms they cause.

Information and diagrams for these notes were compiled using the Official Site of the Nobel Prize (nobelprize.org) on the human immune system which can be found at the following sites:

<http://www.nobelprize.org/educational/medicine/immunity/immune-overview.html>

<http://www.nobelprize.org/educational/medicine/immunity/immune-detail.html>

Practice: Answer on separate paper please!

1. A malfunction of the lymph nodes would most likely interfere with the
 - (1) release of carbon dioxide into the lymph
 - (2) filtering of glucose from the lymph
 - (3) release of oxygen into the lymph
 - (4) filtering of bacteria from the lymph
2. Many bacteria that enter the circulatory system are engulfed and destroyed by
 - (1) phagocytic white blood cell
 - (2) pinocytic red blood cells
 - (3) plasma
 - (4) platelets
3. Many people become infected with the chicken pox virus during childhood. After recovering from chicken pox, these people are usually immune to the disease for the rest of their lives. However, they may still be infected by viruses that cause other diseases, such as measles.
Discuss the immune response to the chicken pox virus. In your answer, be sure to include:
 - the role of antigens in the immune response
 - the role of white blood cells in the body's response to the virus
 - an explanation of why recovery from an infection with the chicken pox virus will not protect a person from getting a different disease, such as measles
 - an explanation of why a chicken pox vaccination usually does not cause a person to become ill with chicken pox
4. Which activity is not a function of white blood cells in response to an invasion of the body by bacteria?
 - (1) engulfing these bacteria
 - (2) producing antibodies to act against this type of bacteria
 - (3) preparing for future invasions of this type of bacteria
 - (4) speeding transmissions of nerve impulses to detect these bacteria
5. State one specific way white blood cells help to protect the human body from pathogens
6. The purpose of introducing weakened microbes into the body of an organism is to stimulate the

7. (1) production of living microbes that will protect the organism from future attacks
 (2) production of antigens that will prevent infections from occurring
 (3) immune system to react and prepare the organism to fight future invasions by these microbes
 (4) replication of genes that direct the synthesis of hormones that regulate the number of microbes

8. Which transplant method would prevent the rejection of tissue after an organ transplant?

- (1) using organs cloned from the cells of the patient
- (2) using organs produced by genetic engineering to get rid of all proteins in the donated organs
- (3) using organs only from pigs or monkeys
- (4) using an organ donated by a close relative because the proteins will always be identical to those of the recipient

9. Allergic reactions usually occur when the immune system produces (1) antibiotics against usually harmless antigens (2) antigens against usually harmless antibodies (3) antibodies against usually harmless antigens (4) enzymes against usually harmless antibodies

Base your answers to questions 10 and 11 on the information below and on your knowledge of biology.

Where is the Beef?

Out Being Irradiated E. coli bacteria in food cause an estimated 73,000 cases of infection leading to some deaths in the United States each year. Until recently, the only way to guarantee meat free of E. coli was to heat it to 160°F, which kills E. coli. The rare hamburgers preferred by many people are not heated to this temperature, and just a few E. coli may cause severe illness.

Recently, ground beef has been decontaminated by irradiation using electron beam technology. The packaged ground beef is scanned by an electron beam that disrupts the genetic structure of the pathogens. This kills them or leaves them unable to reproduce.

This process is considered safe and has been endorsed by various governmental groups in this country as well as the World Health Organization. Irradiation is effective in preserving only certain foods, such as herbs, wheat flour, fresh fruits, vegetables, and some meats. Although some methods of irradiation can change the taste of some foods, this is not an effect of electron beam technology on ground beef.

Opponents of irradiating food are concerned that the process may result in the formation of chemicals that may be harmful or result in a loss of vitamins. Supporters claim that irradiation is safe and should be considered as just another technique for preservation of food.

10. Identify one specific pathogen found in ground beef.
11. Identify the specific group of molecules in bacteria whose function would be interfered with by heating them to 160°F.
12. Scientists have genetically altered a common virus so that it can destroy the most lethal type of brain tumor without harming the healthy tissue nearby. This technology is used for all of the following except
 - (1) treating the disease
 - (2) curing the disease
 - (3) controlling the disease
 - (4) diagnosing the disease
13. Cells of the immune system and the endocrine system of the human body contribute to the maintenance of homeostasis. The methods and materials these two systems use as they carry out this critical function are different. **State two ways cells of the immune system fight disease.**
14. The immune system of humans may respond to chemicals on the surface of an invading organism by
 - (1) releasing hormones that break down these chemicals
 - (2) synthesizing antibodies that mark these organisms to be destroyed
 - (3) secreting antibiotics that attach to these organisms
 - (4) altering a DNA sequence in these organisms

Base your answer to question 15 on the information below and on your knowledge of biology.

Until the middle of the 20th century, transplanting complex organs, such as kidneys, was rarely successful. The first transplant recipients did not survive. It was not until 1954 that the first successful kidney transplant was performed. Success with transplants increased as research scientists developed techniques such as tissue typing and the use of immunosuppressant drugs. These are drugs that suppress the immune system to prevent the rejection of a transplanted organ. In 2002, there were nearly 15,000 kidney transplants performed in the United States with a greater than 95% success rate.

15. Describe the relationship of the immune system to organ transplants and the use of immunosuppressant drugs to prevent the rejection of a transplanted organ. In your answer be sure to:
- state one way the immune system is involved in the rejection of transplanted organs
 - explain why the best source for a donated kidney would be the identical twin of the recipient
 - explain why immunosuppressant drugs might be needed to prevent rejection of a kidney received from a donor other than an identical twin
 - state one reason a person may get sick more easily when taking an immunosuppressant drug