Immune System **Name:** _____

Part 1: ***Lymphocytes***

Lymphocytes and *macrophages* work together to protect your body from a virus attack. After a macrophage encounters a virus, it surrounds and "eats" it. Chemicals inside this white blood cell help to break the virus apart; at least one small fragment of the broken virus is placed on the macrophage's membrane where it acts like a *key* that can activate a resting lymphocyte.

On the membrane of a certain kind of lymphocyte is a *recognition site* that acts like a lock. This lock (recognition site) is specific because only one kind of viral fragment fits into it. For example, a piece of flu virus displayed on a macrophage's membrane can only attach to and activate those lymphocytes that carry a specific recognition site for it.

1. After a macrophage encounters a virus, it _____ and _____ it.
2. The chemicals in the macrophage help to break the virus into _____.
3. One small fragment of the virus is placed on the macrophage's outer _____.
4. The fragment acts like a _____ that activates a resting _____.
5. What is on the membrane of every lymphocyte? _____.
6. A recognition site acts like a _____.
7. A lock carried on the lymphocyte can be activated by only one kind of _____ fragment.

Use the diagrams to help you to answer the remaining questions.

8. Macrophage A has eaten a flu virus. Which lymphocyte carries a recognition site for the flu virus? _____

9. Which macrophage has a capsule particle that can attach to lymphocyte 2? _____

10. Has macrophage C eaten a virus? Explain how you know this?

Part 2: ***Turning On the Immune System***

A "lock-and-key" mechanism mobilizes the immune system. When a macrophage inserts a broken envelope fragment into the receptor site of a special kind of white blood cell called a ***T4 lymphocyte,*** the whole immune system is readied for action. Like a key turning a lock, the virus fragment turns on the T4's machinery to make a chemical called ***interleukin-2***. When released into the blood, interleukin-2 turns on other kinds of white blood cells. ***B lymphocytes*** are affected by inerleukin-2 in a strange way: Interleukin-2 causes B lymphocytes to grow and to divide into other types of cells. Two of these newly formed cells are:

a) **plasma cells**
b) **memory cells**

Plasma cells have an important job to do: They produce specific antibodies against the virus. Antibodies look like small Y's. At the forked ends of each Y are receptor sites that can lock onto the virus's landing gear. With its landing gear covered, the virus cannot land on a healthy cell and use its genetic material to turn the cell into a virus factory.

After you recover from an illness caused by a virus, you may become immune. This means you will never catch the same disease again. Memory cells are responsible for making you immune; they remain circulating in your blood for years, and if the same virus should enter your body again, memory cells will remember the shape of the virus and immediately start producing antibodies before the invader gets a chance to infect the cells.

1. A _____ mechanisms gets the immune system ready for action.
2. When a macrophage inserts a broken envelope fragment into a receptor site, what happens?

_____

3. What happens when interleukin-2 is released into the blood? _____

_____

4. How does interleukin-2 affect B lymphocytes? _____

_____

5. What do plasma cells do? _____
6. What do antibodies look like? _____

7. How do memory cells help you to become immune? _____

_____

8. What do the receptor sites on an antibody do to a virus's landing gear? _____

_____

9. If memory cells make a person immune from the flu, why is it possible for a person with a healthy immune system to catch the flu every year?

_____

_____

Part III ***The T8 Lymphocytes***

Antibodies and macrophages can destroy viruses only before they enter a cell. In many infections, however, viruses slip past this line of defense and enter cells, changing them into virus factories. Unless the immune system has a way of destroying these factories, the body can be severely weakened. Fortunately, interleukin-2 stimulates a group of white blood cells called the ***T8 Lymphocytes***. Two important kinds of T8 lymphocytes are the ***cytotoxic killer cells*** and the ***suppressor cells***.

The term *cyto* means "cell", and the term *toxic* refers to poison. As their name implies, cytotoxic killer cells use a poison to destroy cells. Once cytotoxic killer cells have been stimulated, they seek out and destroy cells that have already been invaded by viruses.

By the combined efforts of the plasma cells (which create antibodies) and the cytotoxic killer cells, the immune system can fight off most virus attackes. But after the battle is won and the memory cells have established immunity against more attacks, the activity of the immune system must be slowed down. Slowing down the immune system is the job of the suppressor cells; they release a chemical that signals the T4 lymphocytes to stop producing interleukin-2. Without interleukin-2, the plasma cells and the cytotoxic killer cells once again become inactive. The memory cells, however, continue to circulate, keeping watch, and the macrophages continue their job of eating new viruses that enter the body.

1. Antibodies and macrophages can destroy viruses only before they enter a _____.

2. In many infections, viruses slip past the first line of defense and enter cells, changing them into _____ factories.

3. Tow important T8 lymphocytes are _____ and _____.

4. What is the job of the cytotoxic killer cell? _____

_____

5. What is the job of the suppressor cell? _____

5. Explain why the job of the cytotoxic killer cell is important. _____

6. The thymus is a small gland that releases T4 and T8 lymphocytes. It is very large in newborn babies and begins to shrink when a child is about six years old. Why do you think it is important for newborns to have a larger thymus gland than adults have? Explain your answer.