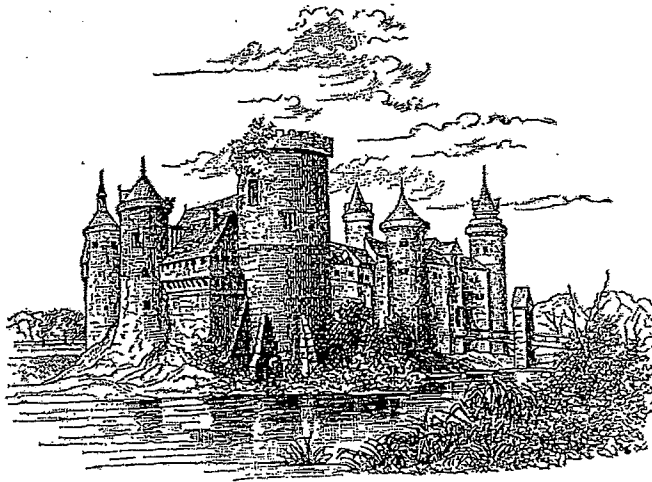


## Immune System



In the castle analogy:

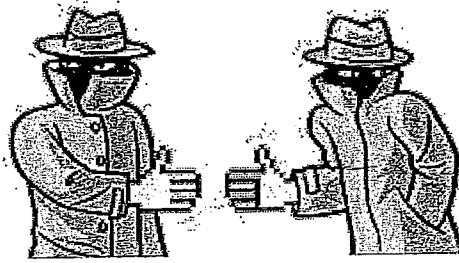
**The first line of defense** is very general: the outside walls, the moat, the drawbridge and so on are designed to keep invaders out in the first place and weaken them so they can't attack. In the human body this includes things like:

1. \_\_\_\_\_ with its acidity, saltiness of our sweat, the oils, and healthy colonies of bacteria
2. \_\_\_\_\_ with its saltiness and antimicrobial enzymes
3. \_\_\_\_\_ that produce mucous that is sticky and catches invaders. The \_\_\_\_\_ in our ears does a similar thing
4. \_\_\_\_\_ in the nose and tiny hair-like structures (cilia) that filter the air or move unwanted particles out
5. \_\_\_\_\_ in the stomach

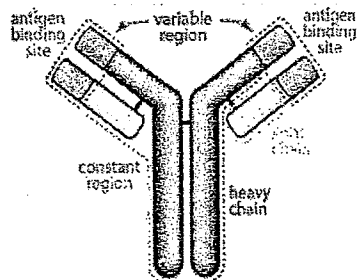


The second line of defense is also very general: the soldiers fight any and every invader that comes in as quickly as they can. These "soldiers" are a type of \_\_\_\_\_ blood cell known as leucocytes. They generally travel in the blood, but when an invader comes in it can be detected by the chemicals on its surface. These markers or signaling chemicals are called \_\_\_\_\_. Then the leucocytes can quickly squeeze between cells to get to the invader and engulf it. The "suicide sacs" or \_\_\_\_\_ will detonate, destroying the invader (the white blood cell itself dies in the process too). Other white blood cells detect damaged cells and clean up the debris. The dead white blood cells, dead invaders, and dead body cells are what we see as pus.

When invaders come in and the soldiers start fighting, an alarm signal is sounded. The body then does other things to help fight off the invaders. The affected area will generally get extra blood sent there and there will be heat and redness and swelling in the area. This is called \_\_\_\_\_ response. It is designed to strengthen the army fighting and weaken the invading army. Also the brain will start to set the thermometer of the body a little higher to prevent the invader from reproducing. When that happens, we say we have a high \_\_\_\_\_. Although the high temperature does help in the battle, if it gets too high it can also harm our own cells that have a lot of protein in them, like our heart cells and brain cells.  $41^{\circ}\text{C}$  can cause convulsions in children and  $43^{\circ}\text{C}$  can seriously harm our own cells, so we usually try to bring that temperature down with medication and cold compresses.



The third line of defense is more specialized. These are like the spy network that gathers intelligence and sends out special highly trained secret agents. This is known at the immune system. Just like the CIA, MI5 and MI6 are very complex, so is the immune system in our body.



### Antibodies:

These are Y shaped chemicals that are produced once an invader has come in. The white blood cells that destroy the invaders ensure that enough identifying information is left intact to allow very specific antibodies to be made. These will attach to the invader's distinctive surface markers (11). This will act like a beacon or alarm for white blood cells to get there even more quickly. They also stop the invader from doing its job very well in the meantime.

Antibodies can also be made to destroy specific 12. \_\_\_\_\_ that are harmful.

Antibodies then stick around to protect the body should that invader ever come again. Vaccinations help produce these antibodies by making the body think the real invader has come. This way we get the protection of antibodies without having the invader actually entering us and doing damage.

**Who makes the antibodies?** Another team of white blood cells: lymphocytes! There are \_\_\_\_\_ types of lymphocytes:

**T lymphocyte:** produced by the bone marrow and lives in the part of the lymphatic system known as the thymus (gland in upper chest behind the breastbone)

- These are also on stand-by until they get the information they need to seek out any of our cells that have already been invaded. Just when the invaders thought they were safely hidden from the leucocytes and the B lymphocytes, the T lymphocytes can find their hiding place and destroy it.

**B lymphocyte:** produced by the bone marrow and lives in the fluids of our body (lymph

- They are just on stand-by until they get the information they need and then start producing antibodies. Their daughter cells will also produce those kind of antibodies. Remember, the antibodies help flag down the big-eater types of white blood cells and stop the invader from working very well)

Whenever the first soldiers (leucocytes) destroy the invader, they preserve the key information about the antigen. A "messenger" cell helps get that information to other leucocytes and to both the T lymphocytes and the B lymphocytes. These helpers are called T helper cells.

It is these T helper cells that the AIDS virus attacks.