

Immune System

A Bird's Eye View

Summary of Immune System © 1988 James W. McAfee

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The Enemies

When the Greeks sought to destroy the mighty city of Troy they built a huge wooden horse which was hollowed out on the inside. Select warriors were placed in the horse. The horse was then set on the outside of the gates of the city and the Greek ships sailed away from the coast and over the horizon. The Trojans took the horse into their city and celebrated their victory. In the middle of the night the warriors left the horse and opened the gates of the city to the Greek armies which had returned under the cover of darkness.

The story of the Trojan horse bears a number of similarities to the attack upon the body by viruses and other enemies of the immune system. Any proper study of the immune system must needs begin with the enemies which the immune system needs to cope with.

Protozoa

Many of mankind's most common diseases are caused by protozoa (from the Greek words for "first animal"). Protozoa are responsible for malaria, amoebic dysentery, and sleeping sickness. Some protozoa wrap themselves with fragments of the tissue of the body they are attacking to hide from the immune system. This is similar to the way in which the Greek armies cloaked their warriors in the Trojan

horse. One protozoa which has created a good deal of concern is giardia lambda which has proliferated in water supplies since 1967.

Worms

In many parts of the world worms create a good many problems. The sun king of France was noted for his hearty appetite. When he died, an autopsy revealed that a huge tapeworm had set up regal residence in his stomach. Worms such as trichinosis can be picked up from undercooked pork. Fish tapeworm has increased about threefold since sushi was introduced to the United States and became popular.

Bacteria

Bacteria are one of man's most formidable enemies. Bacteria cause Boubonic plague, toxic shock syndrome, botulism, legionaire's disease and syphilis. Bubonic plague

destroyed a fourth of the population of Europe in the 14th century. Disease causing bacteria release poisons into the body to weaken the immune system of their prey.

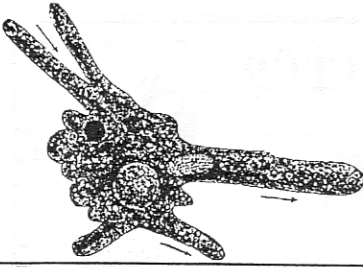
Fungus

In the Middle Ages a disease called St. Anthony's Fire was common. The disease was characterized by painful swelling of the hands and feet accompanied by agonizing pain. In severe cases tissues affected would turn black, dry out and fall off. Hallucinations were common. The disease was caused by the fungus *claviceps pupurea* which grows on moist grain. The fungus releases poisons including a substance quite similar to LSD.

Another fungus which has attracted a good deal of attention is *candida albicans*. The name means "white candle" and refers to white patches which can form with the fungus infection. This fungus can flare up when large amounts of antibiotics or the birth control pill are used.



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The amoeba becomes a health problem in warm climates and under unsanitary conditions.

Viruses

The most dangerous enemy of the human body is probably the virus. Viruses are so small that literally millions could fit on the head of a pin. They are essentially lifeless until they find a "viral recognition site" in the human body. They then inject their genetic code into a cell and take the cell over to make more viruses. One virus can then reproduce 100 to 1000 viruses or more. The viruses will either "bud" out of the infected cell or burst the cell to get out.

Diseases caused by viruses include the flu (which killed 21 million people in 1918-1919), herpes simplex, colds and the dread AIDS virus. The AIDS virus makes a direct assault on the immune system.

The Defenders

The body has armies of defenders to deal with the powerful enemies which attack it. The immune system is composed of white blood cells which originate in the bone marrow (center part of the bone). Illnesses which affect bone marrow such as radiation exposure or lead poisoning can lower immune competence.

Housekeeper Cells

The first layer of defense in the immune system are what are called *macrophages* (big eaters) and *natural killer cells*. These cells can be likened to a housekeeper who travels about a home with a dustcloth keeping things clean. The natural killer cells appear to play an important role in prevention of cancer. The work of the macrophages, as they launch attacks against anything which endangers the body, has proven enchanting to scientists.

The Terminex Squad

A second layer of immune defense originates in the bone marrow but then travels to a gland called the thymus and gets special training there. If a housekeeper were dusting in the basement and myriads of termites began to crawl from the walls she would be at a loss and would call in the exterminators. This is what the body does.

Cells trained by the thymus are technically known as *T-cells*. The thymus trains these cells to specifically recognize and destroy over a million different molecules. After these cells are trained they are as effective as the FBI and the IRS combined! There are three different kinds of T-cells.

Front Linesman

The *T-killer cell*, action cell of the extermination squad, can be likened to the front linesman of a football game. These killer cells directly attack invaders and seek to kill them.

Coach and Cheerleader

The killer cells are provoked to action by the extremely important T-helper cell. *T-helper cells* can be likened to the cheer leaders and coach of a football game. They get the killer cells excited and direct their activities. The AIDS virus attacks the helper cell. The consequence is that the body loses the immune response and is effectively destroyed. Without helper cells most of the components of the immune system can only function poorly.

Umpire

The *T-suppressor cell* is like the umpire of a ball game that makes sure that the rules are followed and that the killer cells do not get carried away and attack their own team members or the audience in the stands. When the suppressor cells are not functioning, people become susceptible to "autoimmune" diseases where the body attacks itself. Such diseases are more common in women leading to the suggestion that the female hormone estrogen may inhibit the function of these cells.

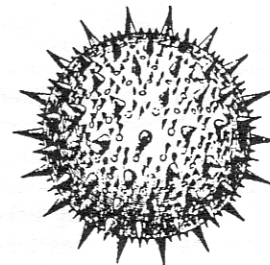
Anti-Terrorist Squad

The body has some dreadful enemies which can be likened to terrorists. They can be extremely elusive and nasty in the damage that they do. The body has an anti-terrorist squad called the *B cells* (from bone marrow). Imagine a terrorist with a super-fast metallic car. The authorities litter the road with tiny but very powerful magnets. As the car moves about it picks up the magnets which eventually begin to exert a "drag" on the car and slow it down so that the vehicles of the authorities can catch up with it. Further imagine that the authorities have explosives which will be attracted to their own magnets when enough of them accumulate in one place. This is how the B cells work.

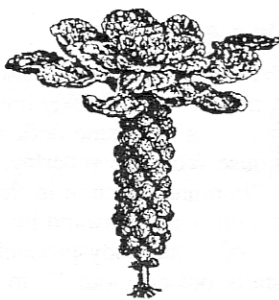
B cells produce substances called *antibodies*. These consist of "Y" shaped strands of protein which are targeted for specific invaders. The important T-helper cells assist the B cells in the manufacture of these antibodies. Antibodies attach to invaders and hold them. They also activate something called the protein complement system.

Protein Complement

Floating around in the blood are fragments of protein called protein complement. When an antibody attaches to an enemy, the complements are attracted to the site where this event occurred. There are 15 different complements which rapidly attach to the site where the antibody was activated. After the final protein complement attaches to the site a mighty explosion takes place. The explosion will damage or destroy the invader.



Viruses are a serious threat to the immune system. The AIDS virus is like a terrorist almost impossible for the immune system to detect.



Vegetables like cabbage, broccoli, and brussel sprouts contain sulfur amino acids which boost immune function.

The importance of protein complement can be seen by the role these substances play in countering a viral attack. Viruses enter a body cell and turn it into a mighty "death star" nurturing and reproducing hundreds or thousands of other viruses. If this "virus nursery" is not destroyed a mighty onslaught of viruses will eventually be loosed on the body. The antibodies and protein complement will attack and destroy body cells that have been invaded by viruses in order to protect and defend the body.

Protein complement, as the name implies, is composed of protein. Poor protein intake or utilization will hamper an effective immune response and result in a collapse of the immune system. Protein complement is produced by the liver and white blood cells.

Chemical Messengers

In a war battles are won or lost by effective communication between different military units. A courageous messenger can win a battle, or an intercepted courier can result in the loss of a battle. The body has important chemical messengers as well.

In the complex immune response chemical messengers composed primarily of protein control operations and determine the effectiveness of bodily defense. One of these is MIF (migration inhibitory factor) which tells the white blood cells to stop their roaming about the body and to "come and dine." Another is LAF (lymphocyte activating factor) which tells the white blood cells to reproduce. A messenger called "tumor necrosis factor" aids the body in attacking cancer cells.

A substance called interleukin 1 tells the body to break down protein

from muscle to use for body defense. If there is a great deal of muscle pain and soreness in an illness it is an indication that a good deal of this chemical messenger has been released and that muscle is being destroyed to provide building material for the immune system to function better.

One of the most important chemical messengers of the immune system is a substance called interferon. Interferon is produced by a cell when it is invaded by a virus. The interferon moves to other cells in the vicinity of the infected cell. When viruses enter these cells they can not take over the genetic machinery to reproduce themselves. Thus interferon "interferes" with the reproductive ability of viruses after they have gained a foothold in the human body. Vitamin C is known to enhance production of interferon.

General References:

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Nutrition and the Immune System

Overall good nutrition is important for a healthy immune system. The bone marrow, liver and thymus are critical in immune function. The liver thrives on large amounts of B complex and protein. Excessive fat, alcohol, and sugar intake hinder liver function.

A good many components of the immune system require protein in order for their manufacture. Adequate protein intake and digestion of this protein is essential to build a healthy immune system.¹

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Proper Digestion

Proper digestion is essential for healthy immune function. The stomach serves as a first line of

defense against invasion by viruses, fungus, and bacteria. Studies have shown that bacteria can actually begin to proliferate in the stomach if the acid which this organ produces is not strong enough.¹

Salmonella infection is much more severe in those who do not produce adequate stomach acid.¹ A dog with up to twice the potency of stomach acid that the average human has can eat a piece of rotting meat without harm, while a human being would likely become very ill.²

Pancreatic enzymes appear to stimulate the early development of the white blood cells, possibly because they improve the breakdown and use of protein.³

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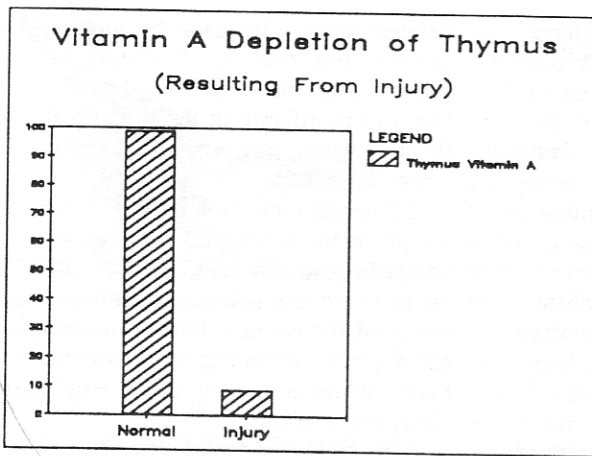
Vitamins

Vitamin A and manganese are important for the functioning of the thymus. An injury may cause the liver to lose 5 percent of its vitamin A, but the thymus can lose 90 to 95 percent. Low levels of vitamin A will reduce the activity of the T-cells.¹

High vitamin A intake increases the rate at which T-cells grow and divide. The macrophages become larger and more aggressive in attacking enemies including cancer cells



Protein digesting enzymes including those found in pineapple can boost immune function by helping the body better digest and absorb protein.



when supplied with generous quantities of vitamin A.

Some have suggested that healthy intakes of vitamin E can protect the membranes of the cells of the immune system. Cheryl Nockels has demonstrated that vitamin E improves the ability of animals to produce antibodies,³ augmenting resistance to disease.

Immunologist Adrienne Benditch of Hoffman LaRoche in New Jersey found that high levels of vitamin E act as an extremely powerful immune stimulant. Levels used were much larger than quantities of vitamin E that would normally be found in the human diet. Since vitamin E is an oil soluble vitamin, it does have potential for toxicity when taken at high levels for a prolonged period. Benditch said, "I was very skeptical of our early results. I didn't believe vitamin E could have so powerful an effect. But I repeated the experiments for several

years, and they made a believer of me."⁴

Deficiency of B complex weakens the immune system. For example, lack of vitamin B5 impairs the ability to produce antibodies.⁵ Lack of vitamin B6 and folic acid have also been shown to seriously hamper antibody function.⁶

Vitamin C is extremely important for immune response. In one study large intake of vitamin C was found to double the rate at which white blood cells were formed in the body in a matter of only three days.⁷

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Minerals

Zinc deficiency results in serious shrinkage of the thymus in animals. Studies of even a mild zinc deficiency of a mouse fetus are sobering. In one study "immune function in these 'deficient' pups—as measured by the numbers of antibody-producing cells—'starts out at about 50 to 60 percent of normal and remains that way through puberty,' even when the pups are raised on a fully zinc-sufficient diet..." Numbers of white blood cells in these animals may be normal, but they do not work efficiently.¹

When mother animals are deprived of zinc, the offspring have a weak immune system for three generations, even when adequate zinc is added back to the diet after pregnancy.²

Another crucial mineral for immune function is selenium, which appears to enable the body to resist cancer. One writer notes that "data do suggest that low selenium intake increases the risk of cancer. Clark found that U.S. counties with intermediate or high forage selenium were inversely associated with cancers of the lung, colon, rectum, bladder, esophagus and pancreas, and all sites combined for both males and females. Cancers of the breast, ovary and cervix also had inverse associations."³

Iron deficiency can create a near collapse of the immune system. Since this deficiency is quite common, it should be taken seriously.⁴

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