The Doctor Within - Part 3
More Immune Components

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The Human Immune System is composed of many components. In Part Two, six were identified. There are other important parts as well.

Lymph vessels, for example. Estimates are that the average body contains well over 420,000 kilometers (or 250,000 miles) of lymph vessels—about four times the number of blood vessels. Laid end-to-end, these lymph vessels would stretch around the equator about 10 times.

The fist-sized powerhouse that is your adult heart beats roughly about 100,000 times per day. Depending on a person's size, it pumps approximately 5.5 liters (six quarts) of blood throughout the body each minute. The lymph fluid leaves your heart as part of the blood but moves out through the walls of tiny capillaries to deliver nutrients and oxygen from the blood to cells all the way from the end of your fingers and toes to the top of your head.

Unlike blood vessels, lymph vessels do not contain muscular walls. They do contain valves that prevent the fluid from back-flow, depending on the movement of large muscle groups around them to move the fluid forward to the heart. You may have noticed that when you sit for long periods of time—as on an airplane or in a chair at work or during long commutes—your ankles and legs may swell with lymph fluid. At that point and ideally before, it's time to get up and exercise.

Lymph nodes—500 or more—are grouped in clusters at strategic intervals in the lymph vessels throughout the body. Operating as strainers, they remove foreign particles (such as bacteria) from the lymph fluid and can even kill invaders. Bacteria, viruses, fungi, metastatic cancer cells, and other harmful organisms can travel in both blood and lymph fluid. Too many in the lymph fluid and the lymph nodes may be unable to strain out and destroy them all.

When the immune system is activated, the lymph nodes begin producing large numbers of white blood cells called lymphocytes to attack the invaders. This can cause the lymph nodes to swell, resulting in heat and pain. Swollen lymph nodes are an early warning signal that something inside the body has triggered the immune system to mount a response. As such, medical personnel usually check for swollen lymph nodes during a physical examination. You may have heard someone say, "I have swollen lymph glands." What they really mean is that some of their lymph *nodes* are swollen.

Now to the brain!

Until quite recently, no one believed that the immune system extended into the human brain. The prevailing idea was that there was no direct connection between the brain and the immune system, that the brain was only connected with the immune system via immune messengers carried in the blood stream. Drawings of immune system components in anatomy textbooks showed nothing in the brain that could be identified as an immune system component. Nada. Zip. To all appearances, the immune system stopped at the 3 pairs of tonsils.

In 2015 this theory changed in a nanosecond when Jonathan Kipnis, MD, a researcher at the Virginia School of Medicine, and Antoine Louveau, a postdoctoral fellow in the Kipnis' laboratory, identified lymph vessels throughout the meninges, the three membranes covering the brain. The brain was directly connected to the immune system by lymphatic vessels *previously thought not to exist.*

How could it be? Probably because 21st Century science has better equipment. Because this stunning discovery overturned decades of textbook teaching, authors around the world scrambled to re-write textbooks!

At the time, Dr. Kipnis was quoted as saying: "I really did not believe there were structures in the body that we were not aware of. I thought the body was mapped . . . This changes entirely the way we perceive the neuro-immune interaction . . . We believe that for every neurological disease that has an immune component, these vessels may play a major role." In individuals with Alzheimer's disease, Dr. Kipnis also theorizes that protein chunks may accumulate in the brain because they are not being efficiently removed by these lymph vessels.

The lymphatic portion of the immune system is way more important than most people realize. The total lymph flow in the body is estimated at about 4 to 5 liters per day. Two or three times more *if* you are active. Thus, the importance of physical exercise!

At this point you might wonder what can *suppress*—or *strengthen*—immune system function. The general answer is whatever *suppresses*—or *strengthens*—the immune system. There *are* some more specific answers, however.

Information about suppressors begins in Part Four.