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Our Amazing "White Bloodstream"

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As vital as the main bloodstream, the intricate and all but invisible lymphatic network is just now beginning to yield its secrets to research. It is one of the world's rivers of mystery—sluggish, largely unmapped, many miles long. A remote Amazon tributary? No, the lymphatic system of your body. The lymphatic system has puzzled physiologists since early Greek times. Only now is the 'white bloodstream' beginning to yield up its secrets—thanks to new tools and laboratory techniques. One thing becomes increasingly clear: our health, even our lives, depend on how well this complex system functions.

In contrast to the bloodstream, which follows a swift-flowing closed circuit from arteries to capillaries to veins and then back to arteries, the lymphatic system flows slowly in a single direction. Its initial rivulets—microscopic in dimension—originates in intercellular spaces. Fluid gathered here passes through ever-enlarging ducts until it reaches the lower neck region, where it empties into veins leading to the heart.

Much of the mystery surrounding the lymphatic system traces to the fact that most of its ducts are so fragile that they are invisible—the smallest have walls of only one-cell thickness. And the fluid they carry is ordinarily almost clear as water. Moreover, at the touch of a probe, all but the largest lymphatic vessels collapse, as they do at death. Exploring such a gossamer stream has called for supreme ingenuity.

Among the aids used in an effort to map the lacy network of ducts, two have been particularly helpful: first, opaque dyes, which cast shadows on X-ray films; second, radioactive isotopes, which leave a track of telltale radiation. [Read the next two paragraphs carefully]

Explorations via these and other techniques reveal fascinating insights into the "geography" of the body.

In many respects the body is like a vast swamp. Its trillions of fluid-bathed cells live an aquatic life. The lymphatic network, it can now be seen, provides an all-important drainage system. To nourish cells, blood capillaries constantly leak minerals, fats, vitamins and sugars, along with fluids and blood proteins. Much excess fluid, together with cellular waste, passes back through capillary walls to be carried away by veins, but not all.

If the lymphatic system did not carry a large portion of this remaining seepage back to the bloodstream, we would all "bleed" to death internally in a matter of hours. Loss of blood proteins through capillary walls would be particularly disastrous.

Recently, Dr. H. S. Mayerson, of Tulane Medical School, tagged blood proteins with radioactive iodine, then measured the rate at which they passed into lymph vessels.

Calculations indicated that half of our blood protein is lost from the blood every 24 hours! But [were it not] for the prompt retrieval of the protein by the lymphatic system this constant loss would spell swift catastrophe.

The route of return is reasonably well known. A gathering system of minute lymph capillaries collects fluid—how, no one knows—and passes it along until it finally reaches the right lymphatic duct or the thoracic duct. The latter is the largest vessel in the lymphatic system; soda-straw-size, it passes some 16 inches upward through the center of the body, finally emptying into the bloodstream.

What propels this great lymphatic system? Reptiles and fish have lymph 'hearts'—pulsating tubes—to move fluid along. Man does not. Apparently—this is one of the lymphatic system's mysteries—lymph is propelled mainly by muscular contractions from breathing, walking, or internal pulsations. As muscles tighten, lymph vessels are squeezed, and fluid is pushed along. Backflow is prevented by flap valves located at regular intervals in the larger lymphatics.

The lymphatic network has other jobs besides drainage and maintenance of fluid balance. Spaced along the channels are hundreds of nodes—bean-shaped masses of tissue that range from pinhead size up to an inch long. They serve as filters, removing dangerous impurities much as an oil filter does in a car. These lymph nodes are so numerous that, if one fails, another a few inches farther along is likely to do the job. This filter system traps almost anything that is potentially harmful—dead red-blood cells, chemicals, even excess tattoo dye. Lymph nodes in the lung areas of city dwellers are often dark from soot filtered out of murky city air.

Suppose you cut your finger or step on a nail. Inevitably, bacteria are carried into the body. They could be lethal but for the lymph nodes that strain them out, then destroy them. Generally, these filters are so efficient that the lymph they finally deliver to the bloodstream is clean and safe.

Still, they can be overwhelmed. The most dramatic examples are offered by that terror of a disease, bubonic plague. Here the lymph nodes struggle valiantly to filter out and destroy the invading organisms, but it is a losing battle.

On a less dramatic scale, we have all seen evidence of lymph-node difficulties. It may seem odd, for example that an infected finger causes pain and swelling in the armpit; of that an infected toe similarly affects the groin. But concentrations of lymph nodes are located in these areas, and discomfort there announces that a battle royal against bacterial invaders is under way.

While lymphatic filtering action is one of the body's greatest protective mechanisms, it can also lead to trouble. Striving to trap anything that would be harmful in the bloodstream, the lymph nodes trap cells shed by cancers. These cancer seeds often sprout and grow there; indeed, this appears to be one of the chief routes of cancer spread. This is why surgeons always pay particular attention to the lymphatic system near a primary cancer. In breast removal, for example, the greatest care is exercised to remove lymphatic and lymph nodes in all surroundings areas, particularly the armpit.

Transport is one of the lymphatic system's big jobs. Mounting evidence indicates that this is probably the route by which some of the critically important hormones are distributed through the body. Another of the system's intriguing activities is the handling of dietary fats. Proteins and carbohydrates are absorbed directly into the bloodstream along the digestive tract. Most fats are not directly absorbed—and with good reason: in heavy concentration, fats are injurious to red-blood cells. The lymphatic system solves this problem by absorbing fats from the intestine and dribbling them into the bloodstream in amounts that can be safely handled.

The lymphatic system also produces antibodies, which destroy invading bacteria, and it manufactures at least one-fourth of the infection-fighting white cells that circulate in the bloodstream. Whenever infections develop, the lymphatic system goes into frantic activity, producing white cells by the tens of thousands and rushing them to the scene of trouble.

Usually, the lymphatic system performs so efficiently that we are hardly aware of its existence. Still, from time to time it does announce its presence. On long plane rides and in theaters, women sometimes kick off their shoes. Reason: when the feet are inactive, fluid stops flowing and collects; feet swell. During surgery, lymph channels are inevitably severed, where upon fluid collects in intercellular spaces, swelling follows in the surgical area and persists until new lymph channels sprout. Children after suffer from 'swollen glands,' particularly in the neck area. This means that lymph nodes "glands" are inflamed.

At times, too, the system lacks the reserve capacity to handle jobs thrust upon it. In the lungs, for example, blood vessels may ooze fluid faster than the lymphatics can carry it away. This can happen in pneumonia, in certain type of heart disease or when irritating chemicals damage lung tissue. Unless the lymphatic system can meet the challenge, the victim may drown in his own juices.

The lymphatic system has its own special disease problems. It is the chief target of lymphatic leukemia, and of Hodgkin's disease—a

cancer like illness marked by enlargement of nodes. Until lately, medical texts said that the latter disease was always fatal. Recent advances offer some hope of changing the picture, however. High-voltage radiations appear to destroy the lymph system. In one recently reported series of cases, where treatment was begun early, two thirds of those treated in this manner were alive at the end of five years—the usual yardstick of cancer cure.

Other studies suggest a link between lymphatic difficulties and deposition of fat in artery walls—which can lead to blockage of heart arteries and to death. Similarly, there may be a link between lymphatic disorders and serious malfunction of the kidney.

Thus, this great river of mystery may well hold the key to dozens of disease riddles. As it is given ever-increasing research attention, discoveries of vital importance to all of us will inevitably be made along its banks.