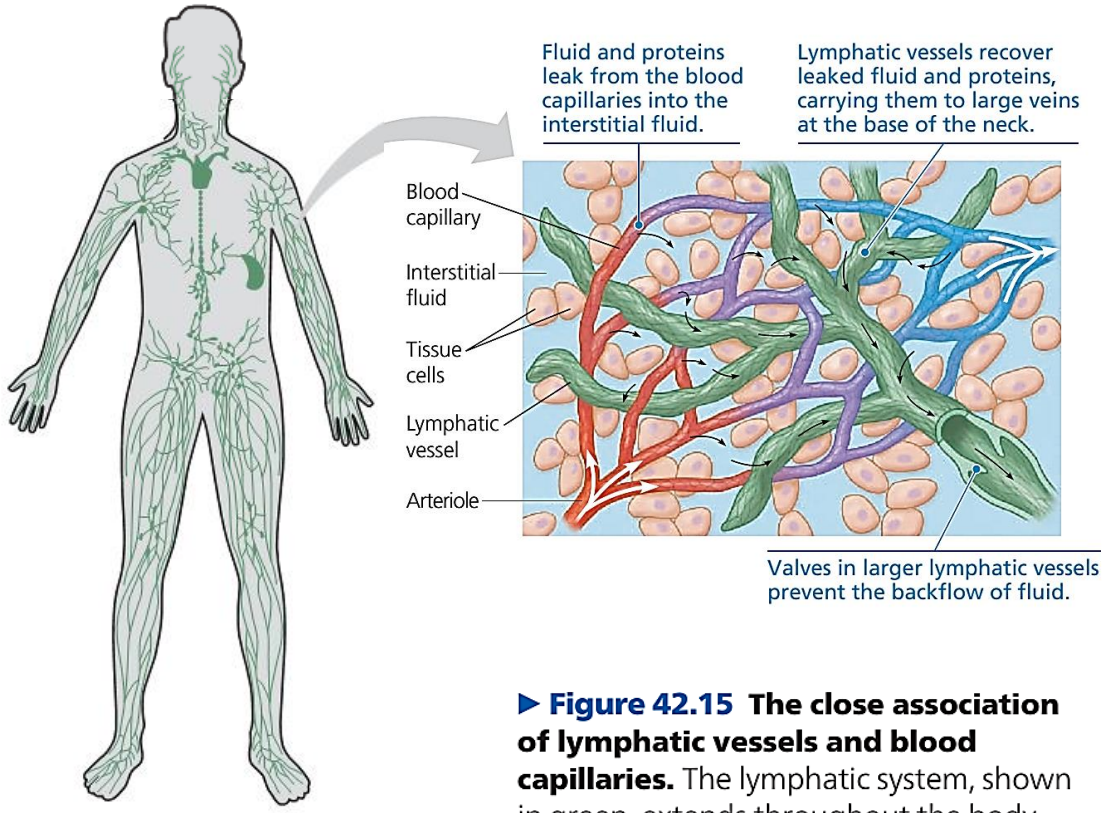
Fluid Return by the Lymphatic System

Each day the adult human body loses approximately 4–8 L of fluid from capillaries to the surrounding tissues. There is also some leakage of blood proteins, even though the capillary wall is not very permeable to large molecules. The lost fluid and the proteins within it are recovered and returned to the blood via the lymphatic system. As shown in Figure 42.15, fluid diffuses into the lymphatic system via a network of tiny vessels intermingled with capillaries. The recovered fluid, called lymph, circulates within the lymphatic system before draining into a pair of large veins of the cardiovascular system at the base of the neck. This joining of the lymphatic and cardiovascular systems completes the recovery of fluid lost from capillaries as well as the transfer of lipids from the small intestine to the blood. Disruptions in the movement of lymph often result in fluid accumulation, or edema, in affected tissues. In some circumstances, the consequence is severe. For example, certain species of parasitic worms that lodge in lymph vessels and thereby block lymph movement cause elephantiasis, a condition marked by extreme swelling in limbs or other body parts.



► **Figure 42.15 The close association of lymphatic vessels and blood capillaries.** The lymphatic system, shown in green, extends throughout the body, terminating in narrow vessels intermingled with blood capillaries. The terminal lymphatic vessels have closed ends, but are permeable to interstitial liquid flowing in from surrounding tissue. Before reaching the heart, fluid in the lymphatic system undergoes filtering and monitoring by the immune system at small, bean-shaped structures called lymph nodes.

Lymphatics are tiny, blind-ending vessels, which are found in almost all tissues of the body. Lymphatics contain tiny valves, which allow the tissue fluid to flow in but stop it from leaking out. The valves in the lymph vessel walls are wide enough to allow large protein molecules to pass through. This is very important because such molecules are too big to get into blood capillaries, and so cannot be taken away by the blood. If your lymphatics did not take away the protein in the tissue fluid between your cells, you could die within 24 hours. If the protein concentration and rate of loss from plasma are not in balance with the concentration and rate of loss from tissue fluid, oedema may result.

Along a lymph vessel are small, lymph-filtering organs called lymph nodes, which play an important role in the body's defense. Inside each lymph node is a honeycomb of connective tissue with spaces filled by white blood cells, which function in defense. When the body is fighting an infection, the white blood cells multiply rapidly, and the lymph nodes become swollen and tender. This is why your doctor may check for swollen lymph nodes in your neck, armpits, or groin when you feel sick. Because lymph nodes may also trap circulating cancer cells, examining the lymph nodes of patients with cancer may reveal the spread of the disease.

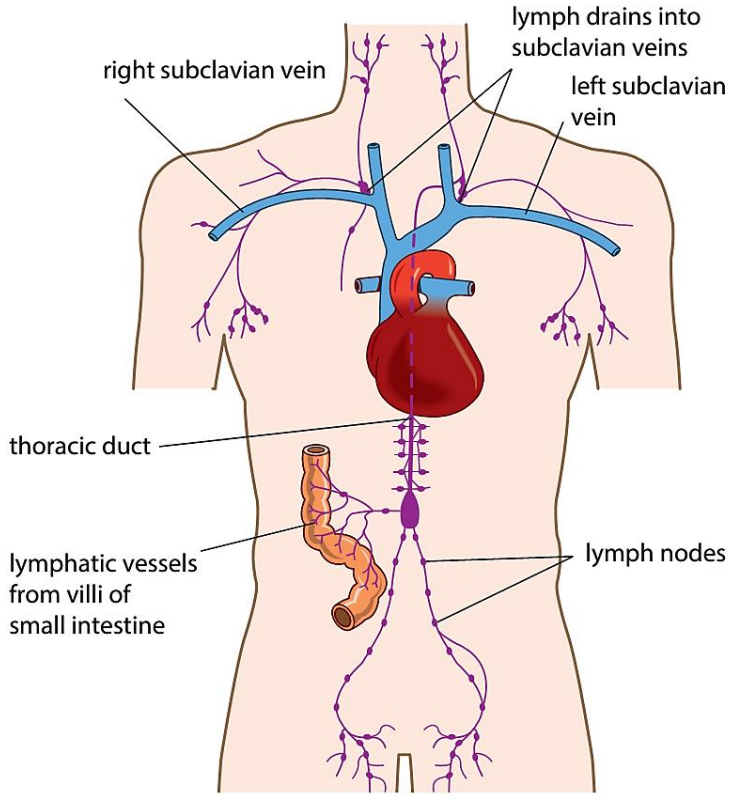


Figure 8.12 Outline of the human lymphatic system.

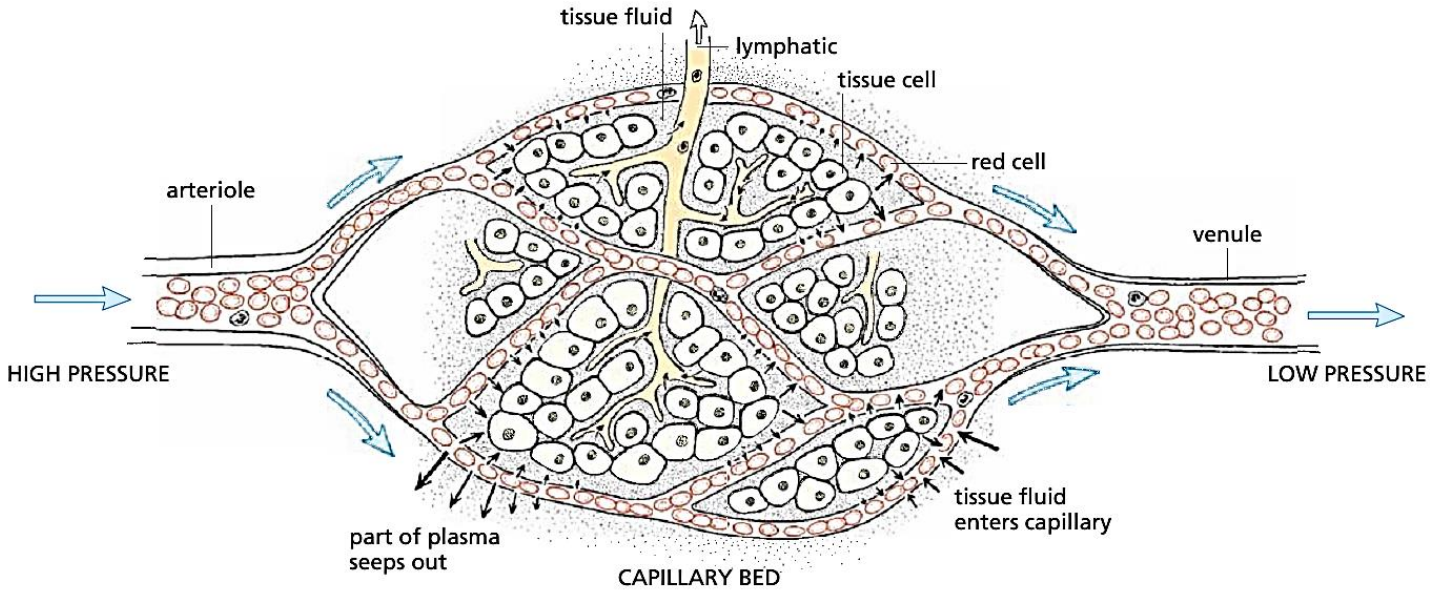


Figure 9.16 Relationship between capillaries, cells and lymphatics. The slow flow rate in the capillaries allows plenty of time for the exchange of oxygen, food, carbon dioxide and waste products.

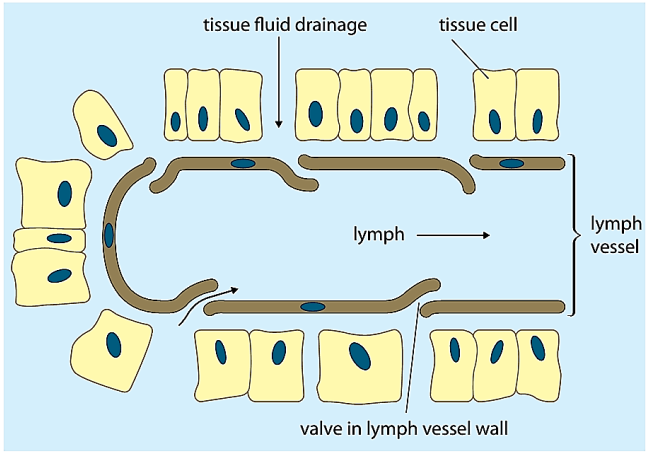


Figure 8.11 Drainage of tissue fluid into a lymph vessel.