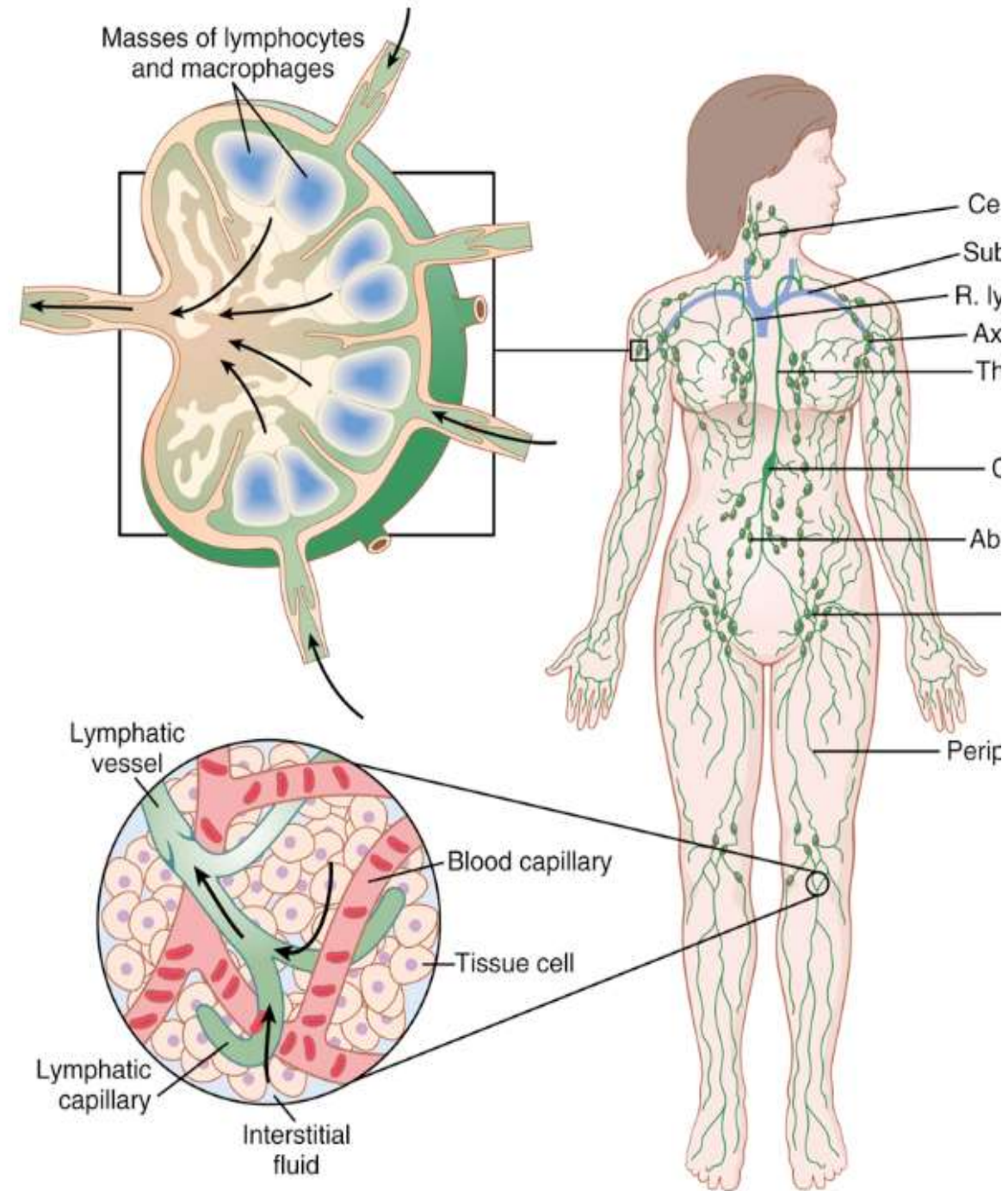


Lymphatic System

Fatima Daoud, MD, PhD.



Hematology

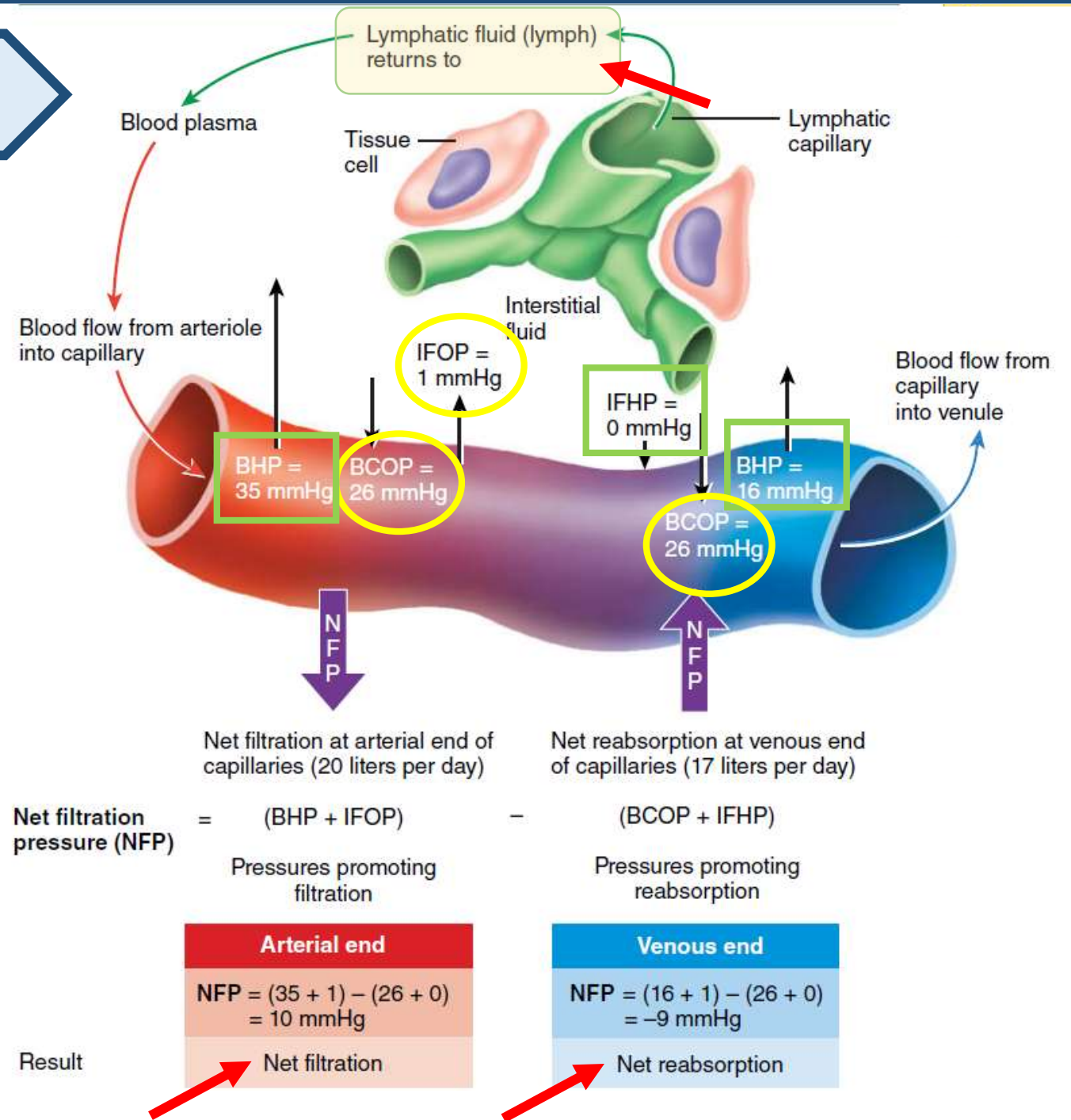
Body Fluids

Key:

BHP = Blood hydrostatic pressure
 IFHP = Interstitial fluid hydrostatic pressure
 BCOP = Blood colloid osmotic pressure
 IFOP = Interstitial fluid osmotic pressure
 NFP = Net filtration pressure

Blood hydrostatic pressure pushes fluid out of capillaries (filtration)

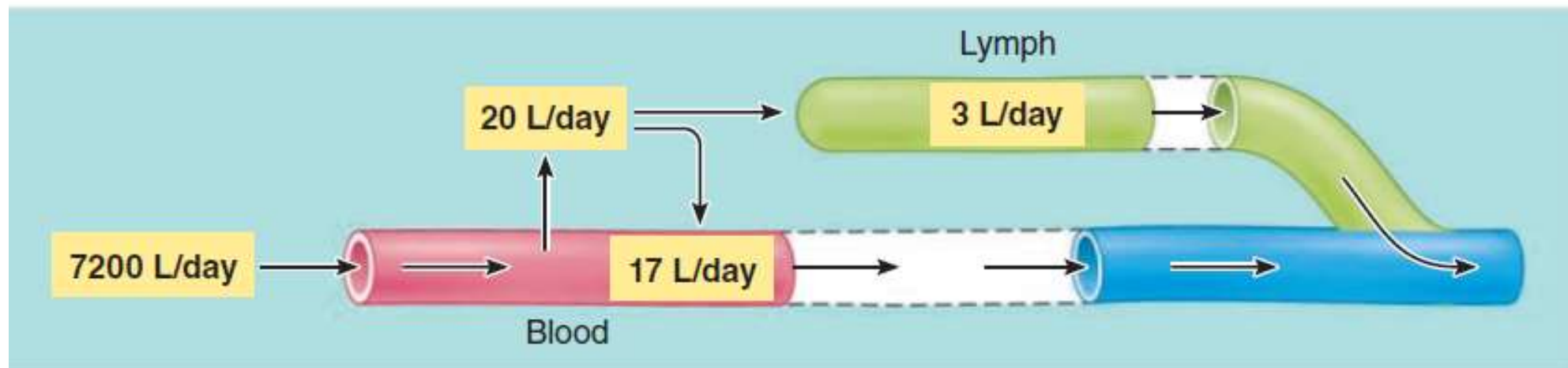
Blood colloid osmotic pressure pulls fluid into capillaries (reabsorption)



Hematology

Lymph

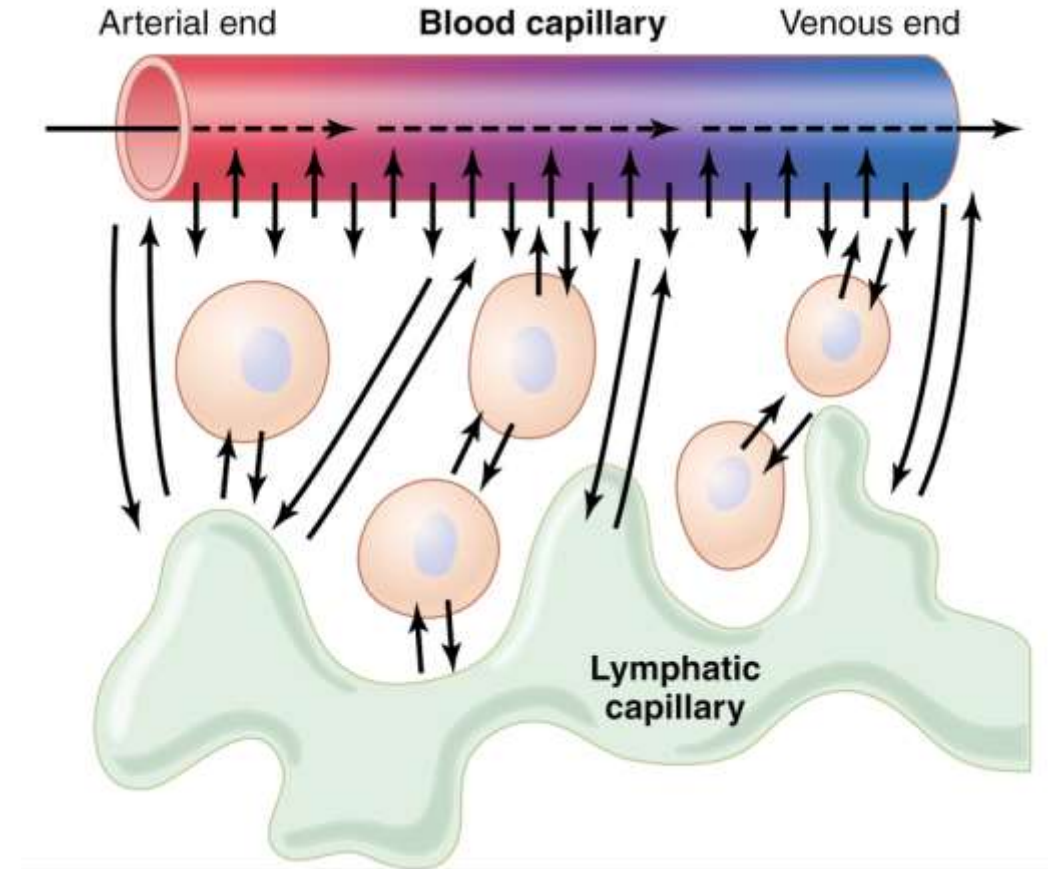
- Even under normal circumstances, slightly more fluid is filtered out of the capillaries into the interstitial fluid than is reabsorbed from the interstitial fluid back into the plasma.
- On average, about one tenth of the fluid instead enters the lymphatic capillaries and returns to the blood through the lymphatic system rather than through the venous capillaries. The total quantity of all this lymph is normally only 2 to 3 L/day.



Lymph

Composition

- Lymph is derived from interstitial fluid that flows into the lymphatics. Therefore, lymph as it first enters the terminal lymphatics has almost the same composition as the interstitial fluid.



Lymph

Circulation

These lymphatic valve-like openings are larger than the pores in blood capillaries. Consequently, large particles in the interstitial fluid, such as escaped plasma proteins and bacteria, can gain access to initial lymphatics but are excluded from blood capillaries.

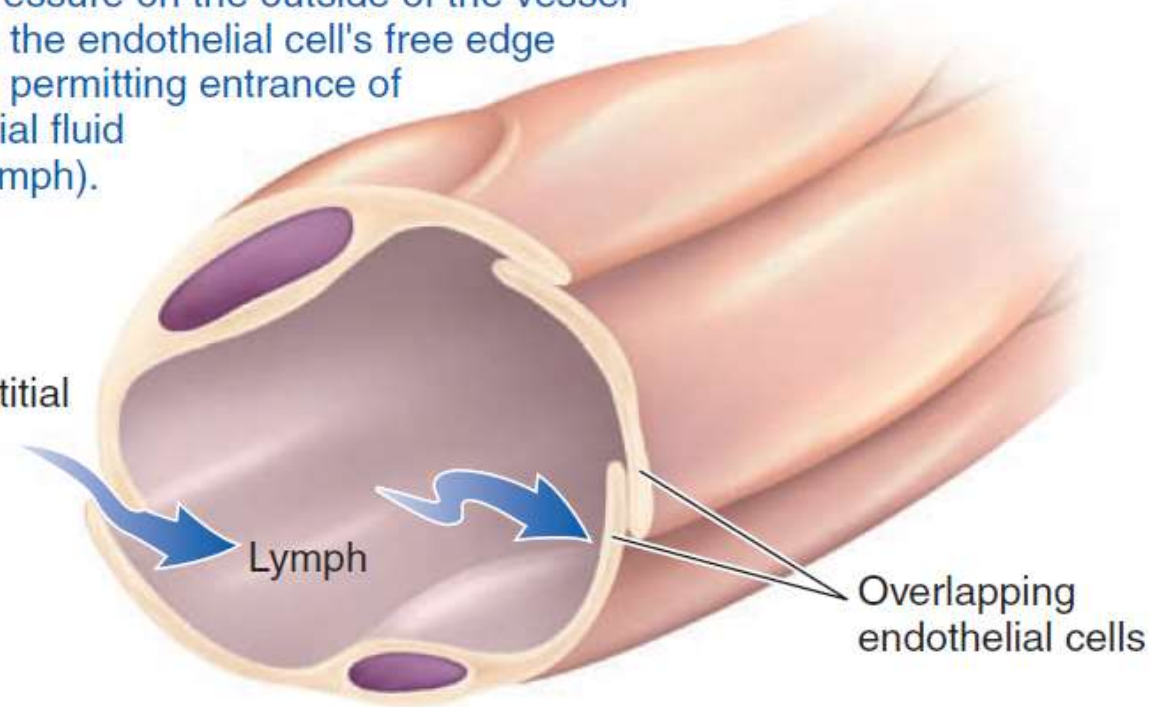
Fluid pressure on the outside of the vessel pushes the endothelial cell's free edge inward, permitting entrance of interstitial fluid (now lymph).

Interstitial fluid

Lymph

Overlapping endothelial cells

Fluid pressure on the inside of the vessel forces the overlapping edges together so that lymph cannot escape.

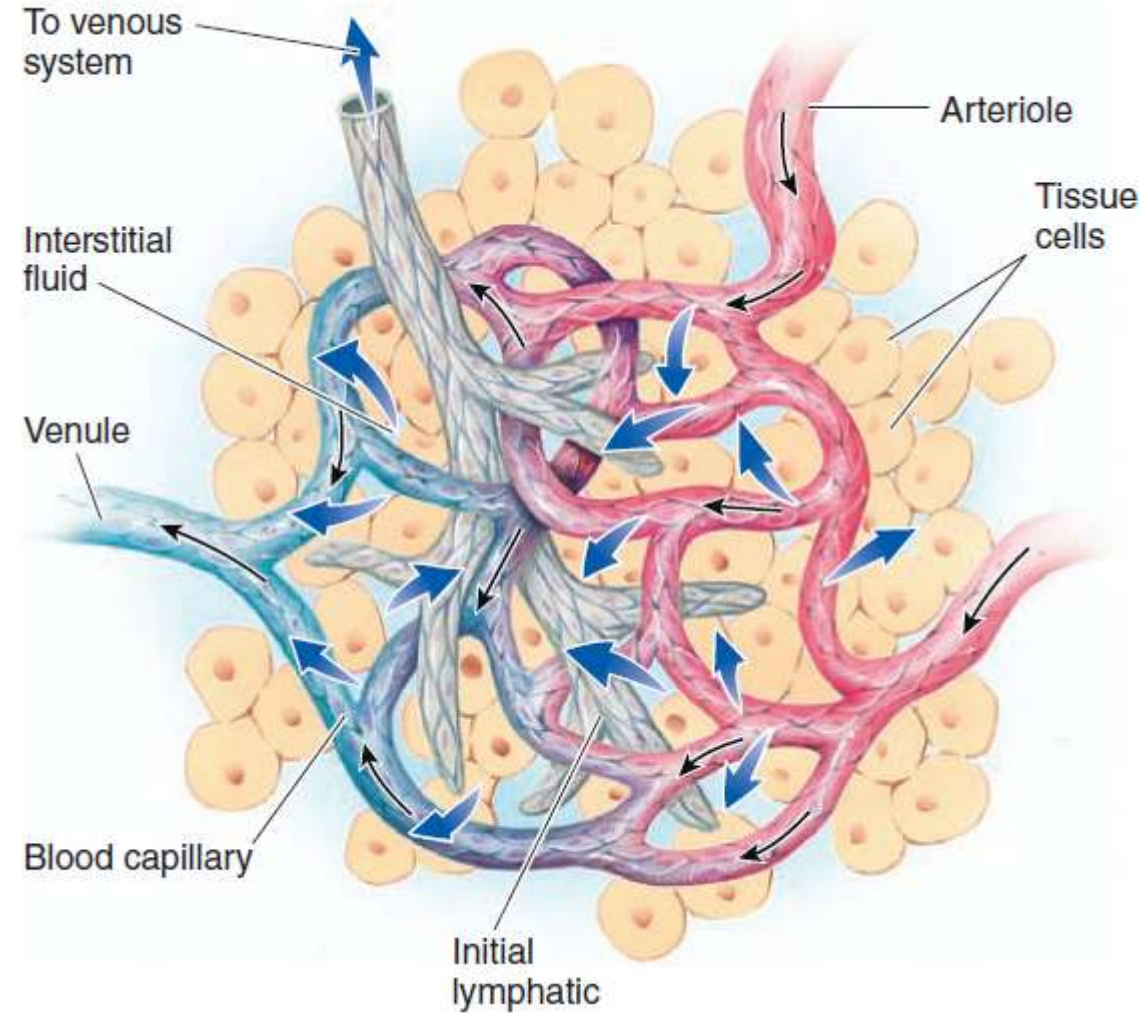


Lymph

Circulation

lymph is directed from the tissues toward the venous system by two mechanisms:

1. lymph vessels beyond the initial lymphatics are surrounded by smooth muscle, which contracts rhythmically as a result of myogenic activity.

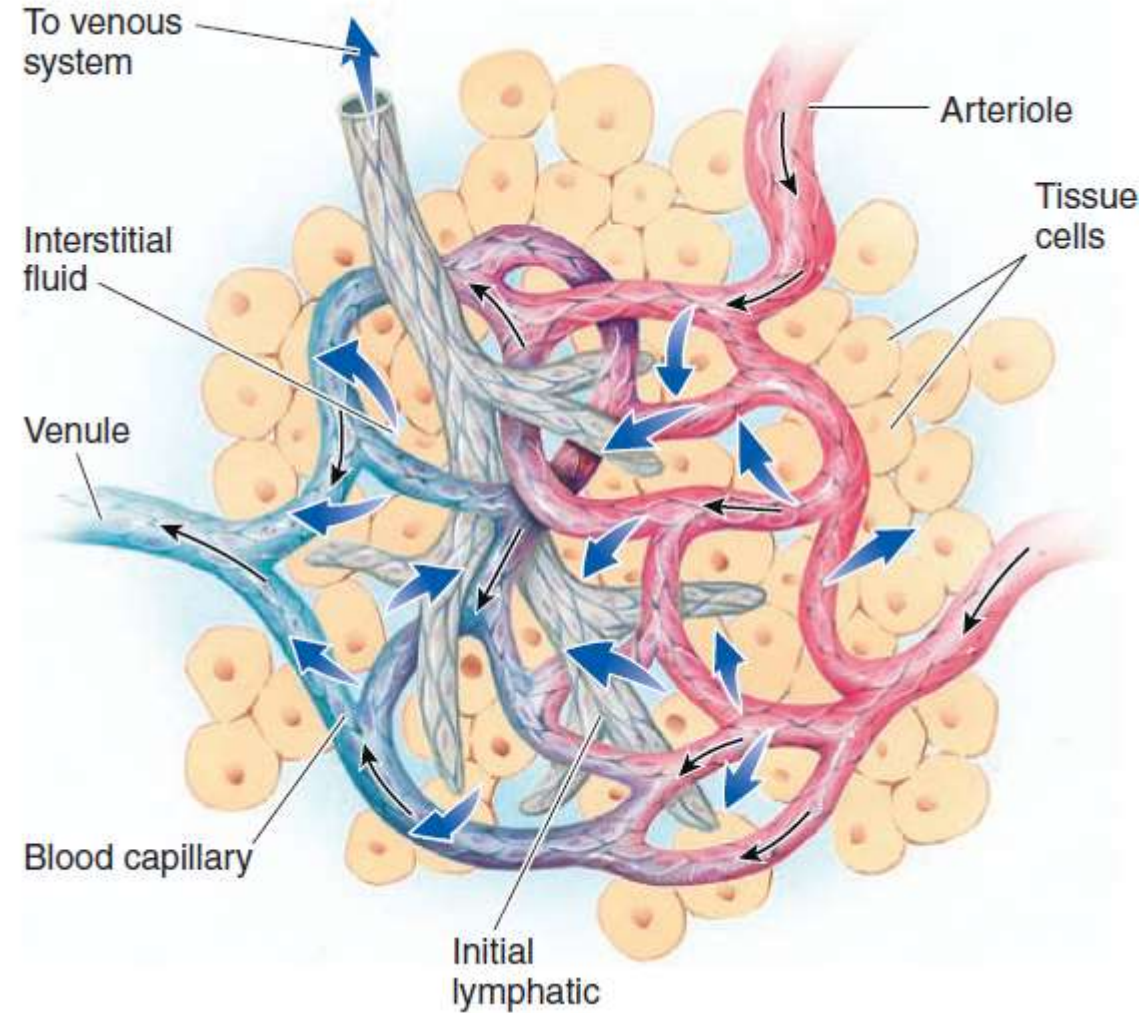


Lymph

Circulation

lymph is directed from the tissues toward the venous system by two mechanisms:

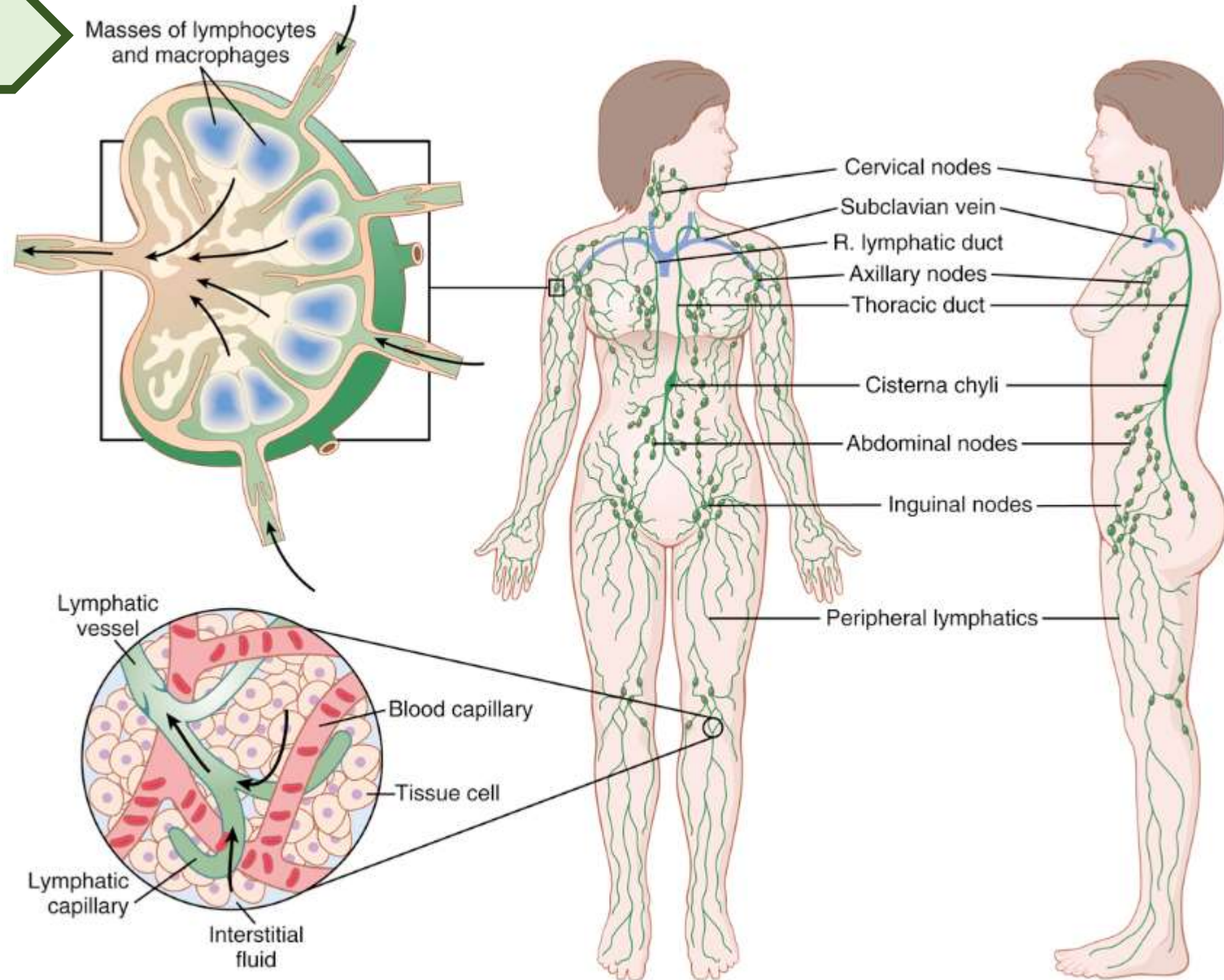
2. Contraction of skeletal muscles squeezes the lymph out of the vessels.



Lymph

Circulation

- Almost all tissues of the body have special lymph channels that drain excess fluid directly from the interstitial spaces





Lymph

Circulation

- lower part of the body → empty into the thoracic duct → empties into the blood venous system.
- Left side of the head, left arm, and parts of the chest region → thoracic duct before it empties into the veins.
- Right side of the neck and head, right arm, and parts of the right thorax enters the right lymph duct.



(b) Areas drained by right lymphatic and thoracic ducts

-  Area drained by right lymphatic duct
-  Area drained by thoracic duct



Lymph

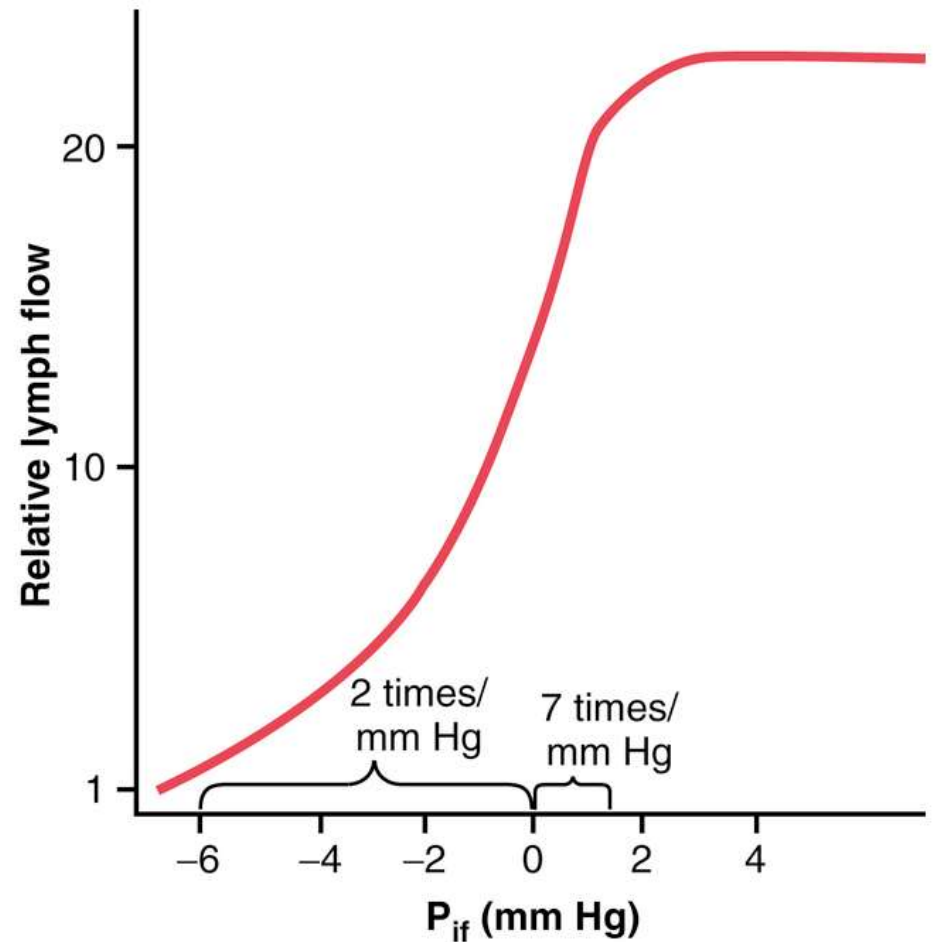
Function

- Return of excess filtered fluid.
- Defense against disease.
- Transport of absorbed fat.
- Return of filtered protein.

Relationship between interstitial fluid pressure and lymph flow

All these factors favor net fluid movement into the interstitium, thus increasing interstitial fluid volume, interstitial fluid pressure, and lymph flow all at the same time

- Elevated capillary hydrostatic pressure
- Decreased plasma colloid osmotic pressure
- Increased interstitial fluid colloid osmotic pressure
- Increased permeability of the capillaries



Lymph

Rate of lymph flow

Two primary factors that determine lymph flow are:

- (1) the interstitial fluid pressure.
- (2) the activity of the lymphatic pump.



Lymph

Edema

There are two general causes of extracellular edema:

- (1) abnormal leakage of fluid from the plasma to the interstitial spaces across the capillaries; and
- (2) failure of the lymphatics to return fluid from the interstitium back into the blood, often called **lymphedema**

Lymph

lymphedema

Blockage of lymph return due to:

A. Cancer

B. Infections (e.g., filarial nematodes)

C. Surgery

D. Congenital absence or abnormality of lymphatic vessels