SOME NOTES ABOUT FORCES MOVING WATER INTO AND OUT OF CAPILLARIES:

A. Movement of large amount of fluid from areas of high pressure to areas of low pressure.
Fluid is filtered out of capillaries at arterial end, and reabsorbed at venous end.
These fluids contribute to volume of fluid in blood vessels and interstitial space.

B. Capillary (blood) hydrostatic pressure (BHP)
BP drops from arterial end to venous end of capillaries.
BHP at arterial end is 35 mm Hg; BHP at venous end is 17 mm Hg.

C. Interstitial fluid hydrostatic pressure (IHP)
There is very little fluid in interstitial space b/c it is drained by lymphatic vessels.
At any given time IHP may be slightly positive or slightly negative; so, assume IHP is 0 mm Hg.

D. Net hydrostatic pressure on capillaries = difference between BHP and IHP.
Since IHP = 0, NHP equals BP at arterial and venous ends of capillaries (35 & 17).

E. Capillary (blood) colloid osmotic pressure (BCOP)
Pulls water into capillaries by osmosis – concentration of water in capillaries is low due to abundance of plasma proteins.
BCOP = 26 mm Hg; same entire length of capillaries.

F. Interstitial fluid colloid osmotic pressure (ICOP)
Water moves into capillaries because concentration of water in interstitial fluid is higher than in capillaries because there are only a few plasma proteins present in interstitial fluid.
ICOP = 1 mm Hg

G. Net osmotic pressure on capillaries = difference between BCOP and ICOP (26 & 1).
Pulls fluid back into capillary - NCOP is constant b/c capillaries have more proteins and the proteins do not diffuse across the membrane.

H. Filtration - fluids move out of capillary beds at arterial end b/c hydrostatic forces dominate.
NFP = (BHP – IHP) – (BCOP – ICOP)
NFP = (35 – 0) – (26 – 1)
NFP = 35 – 25
NFP = 10 mm Hg at arterial end (positive number) = fluids move out of capillaries

I. Reabsorption - fluids move into capillary beds at venous end b/c osmotic forces dominate.
NFP = (BHP – IHP) – (BCOP – ICOP)
NFP = (17 – 0) – (26 – 1)
NFP = 17 – 25
NFP = -8 mm Hg at venous end (negative number) = fluids move into capillaries

J. Edema = filtration > reabsorption

CARDIOVASCULAR FITNESS AND HEALTH – athletes vs. nonathletes **Table 21-3**

1. Trained athletes have _____ *(larger or smaller)* hearts than nonathletes.
2. Trained athletes have _____ *(higher or lower)* stroke volume than nonathletes.
3. For the same cardiac output, but larger stroke volume in athletes, the heart rate of athletes is _____ than in nonathletes. *(higher or lower)*
4. Therefore, a trained athlete _____ tolerate levels of sustained activity that a nonathlete _____ tolerate. *(can or cannot)*

MORE ON PRELOAD AND AFTERLOAD

5. Increased preload is due to more filling time between systole. What happens to SV? _____
   What would decrease preload? _____
   _____
6. Increased afterload results in less blood being pumped. What happens to SV? _____
   What can cause increased afterload?_____

PULMONARY CIRCULATION

7. Exchange of O_2 and CO_2 between _____ and _____ in lungs.
8. Air sacs have higher levels of _____ and lower levels of _____ than the capillaries surrounding them, which have higher levels of _____ and lower levels of _____.
9. Explain the direction the gases are diffusing._____

FETAL CIRCULATION

10. Umbilical arteries take _____ blood away from fetus.
    Umbilical veins take _____ blood toward fetus.
11. Gases are exchanged in the _____.
12. The _____ is an opening in the septum between the atria.
13. The _____ is a shunt between the aorta and the pulmonary trunk.
14. Why isn't there a problem with mixing oxygenated and deoxygenated blood in the fetus?
    _____

1. larger
2. higher
3. lower
4. can; cannot
5. SV increases; regurgitation of blood into atria, stenosis (smaller opening) of mitral valve which would allow less blood to flow from atrium to ventricle
6. SV decreases; decreased blood to ventricle results in increased blood in atria, which leads to edema and increased afterload
7. pulmonary capillaries; alveoli
8. air sacs – higher oxygen, lower carbon dioxide;
   capillaries – higher carbon dioxide; lower oxygen
9. oxygen diffuses from air sacs to capillaries; carbon dioxide diffuses from capillaries to air sacs
10. umbilical arteries – deoxygenated; umbilical veins – oxygenated
11. placenta
12. foramen ovale
13. ductus arteriosus
14. fetus receives oxygen from the mom; baby's lungs are nonfunctioning at this point