11.3: Blood Vessels in the Body

Distance from Toronto to Japan: 10,349 km
All blood vessel connect straight: 19,000 km

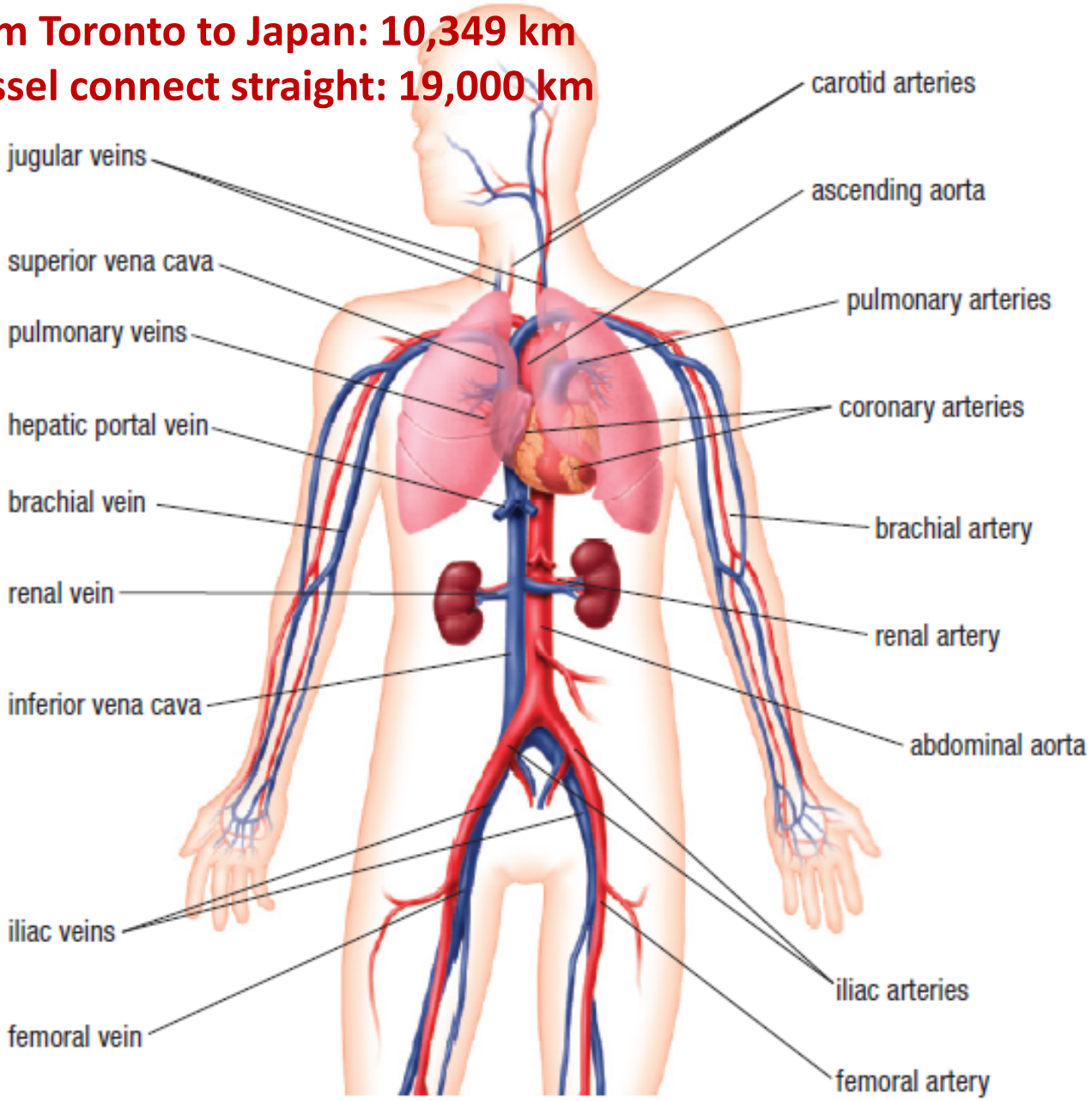
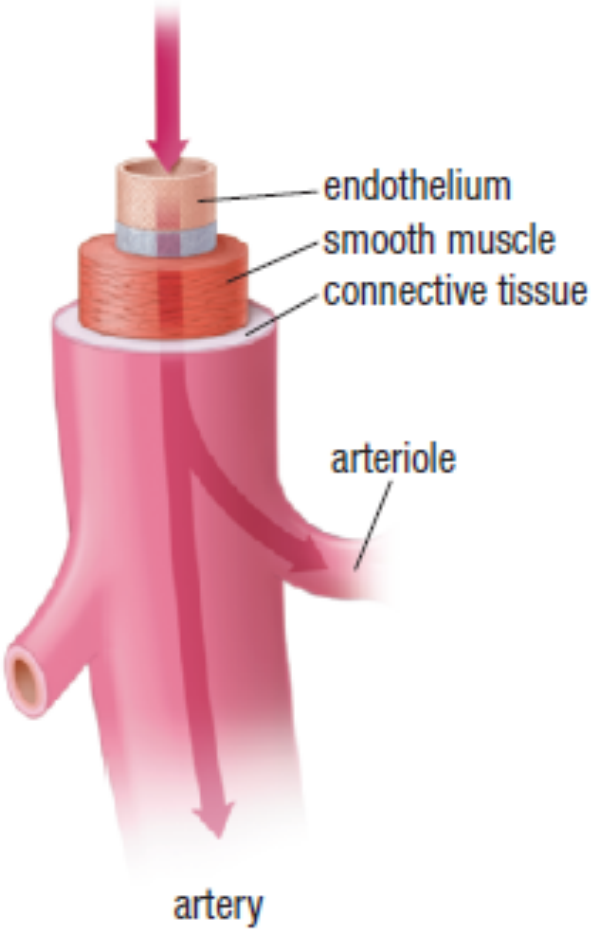


Figure 1 The major arteries and veins of the human circulatory system

Arteries



- Arteries carry blood away from the heart to the tissues
- 3 layers of tissue
- They expand slightly when heart contracts, and return to original size when the heart relaxes
- This expansion can be felt as a pulse
- Try to find your pulse on your radial and carotid arteries. How does pulse differ at these two points?
- Arteries branch into arterioles, their diameter can be controlled by the nervous system

Controlling Blood Flow in Arterioles

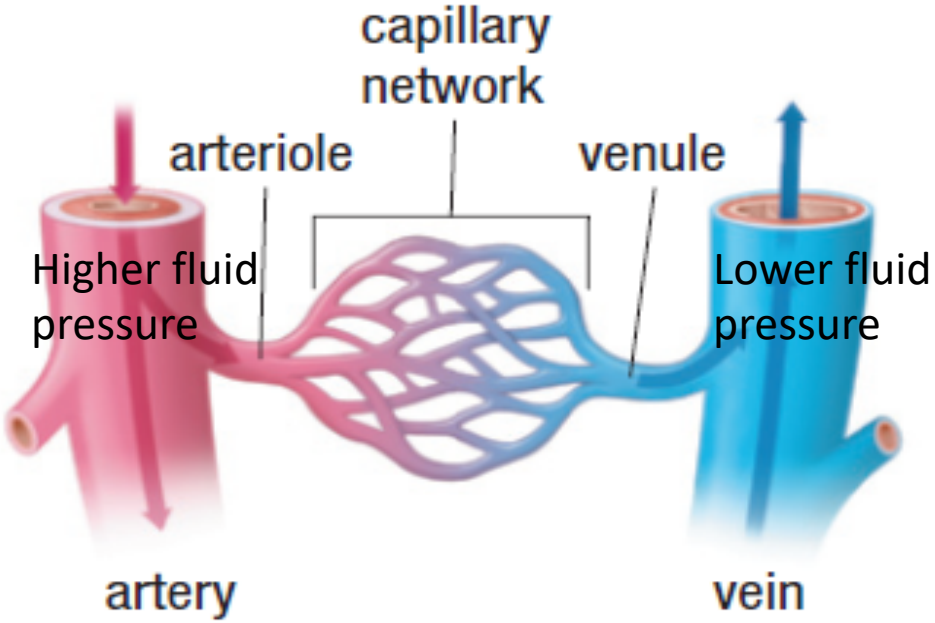
- Vasodilation – an increase in the diameter of arterioles that increases the blood flow to tissues
- Ex. blushing

- Vasoconstriction – a decrease in diameter of arterioles that decreases blood flow to tissues
- Ex. Pale fingers when they are cold

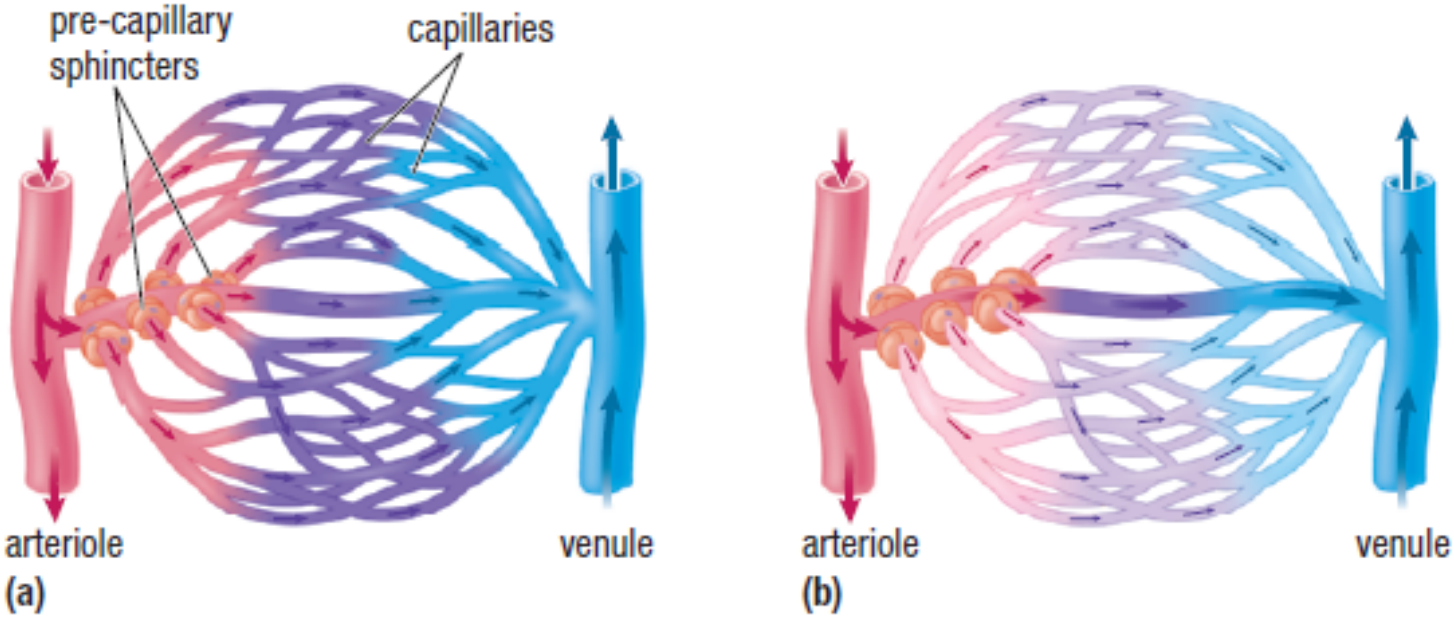
Capillaries

- Capillaries are the smallest blood vessels

- Capillary walls are only one cell thick so that oxygen and nutrients can diffuse into fluids surrounding cells, while carbon dioxide and wastes can diffuse into the capillaries to be removed



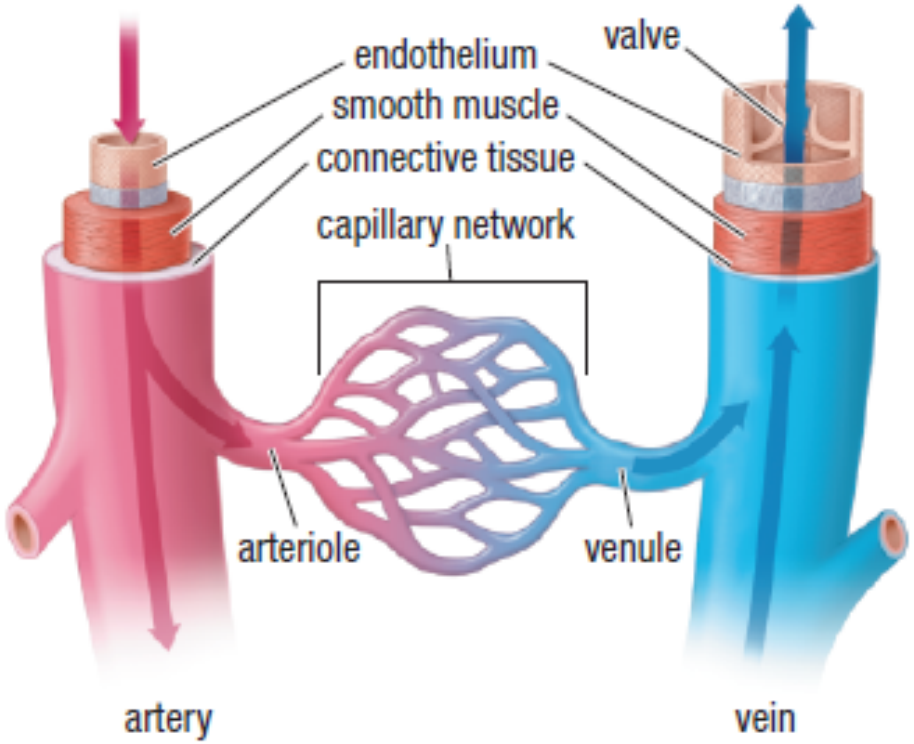
Controlling Blood Flow in Capillaries



- (a) Pre-capillary sphincter muscles are relaxed and blood flow through the capillary network is at a maximum.
- (b) The sphincter muscles are contracted, allowing minimal blood flow through the capillary network.

Venules and Veins

- A venule is the smallest vein; formed by the merging of capillaries
- Veins carry blood from the tissue back to the heart
- Veins carry blood at lower pressure compared to arteries, and are thinner walled



Venules and Veins

- Veins have <u>one way valves</u> and rely on skeletal muscle contractions to keep blood flowing one way back to the heart

- What happens if those valves don't work properly?
  - Military personnel fainting – blood pool in lower body, not enough blood push back to heart and brain
  - Varicose veins: blood accumulate and veins do not rebound

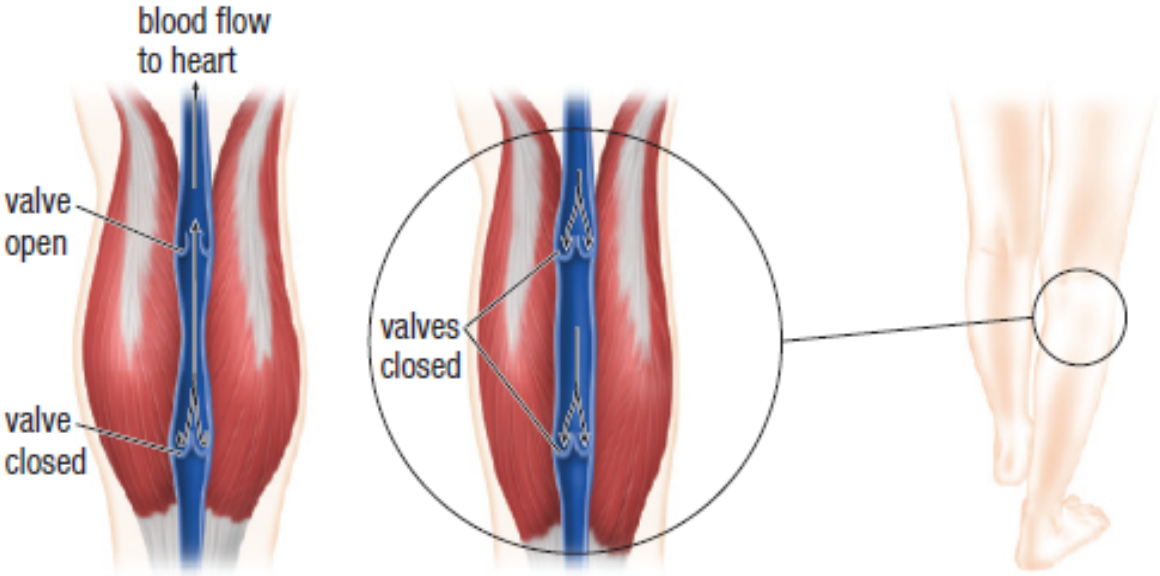


Figure 9 The contraction of the muscles squeezes the veins, and the valves keep the blood flowing in the right direction.

Blood Pressure

- Sphygmomanometer – with an inflatable cuff and a display.
- The cuff is inflated first, then as the pressure is released from the cuff, pressure sensors in the cuff detect the vibrations of the blood flowing through the branchial artery.

- The first reading is the **systolic pressure**, which is the pressure in the artery when the heart contracts, normally about 120 mm Hg. The second reading is taken when the heart is relaxed and blood is flowing through the artery. This is called the **diastolic pressure**, normally 80 mm Hg.

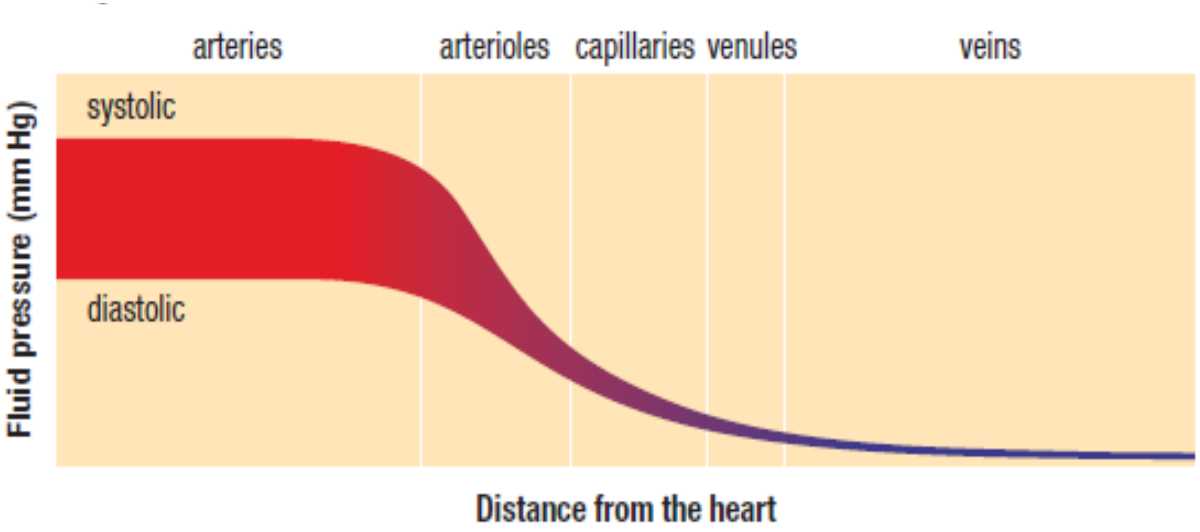
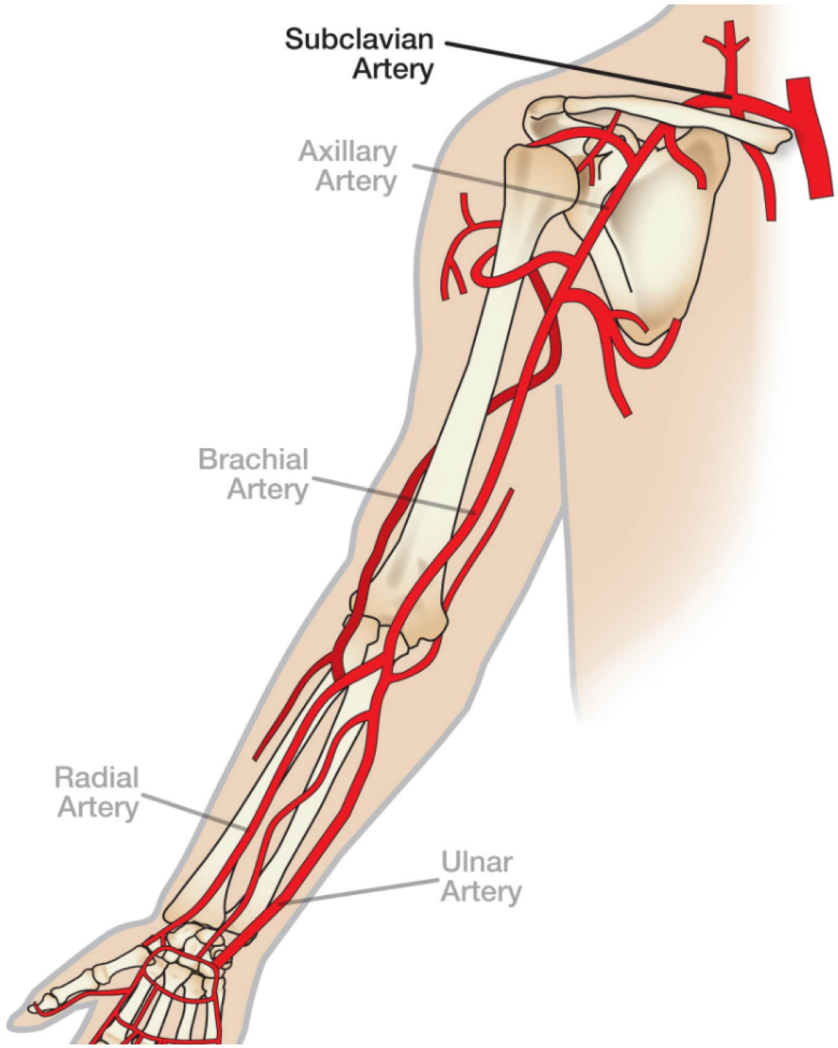


Figure 11 By the time the blood gets back to the heart, it is under very low pressure.


Sphygmomanometer Cuff

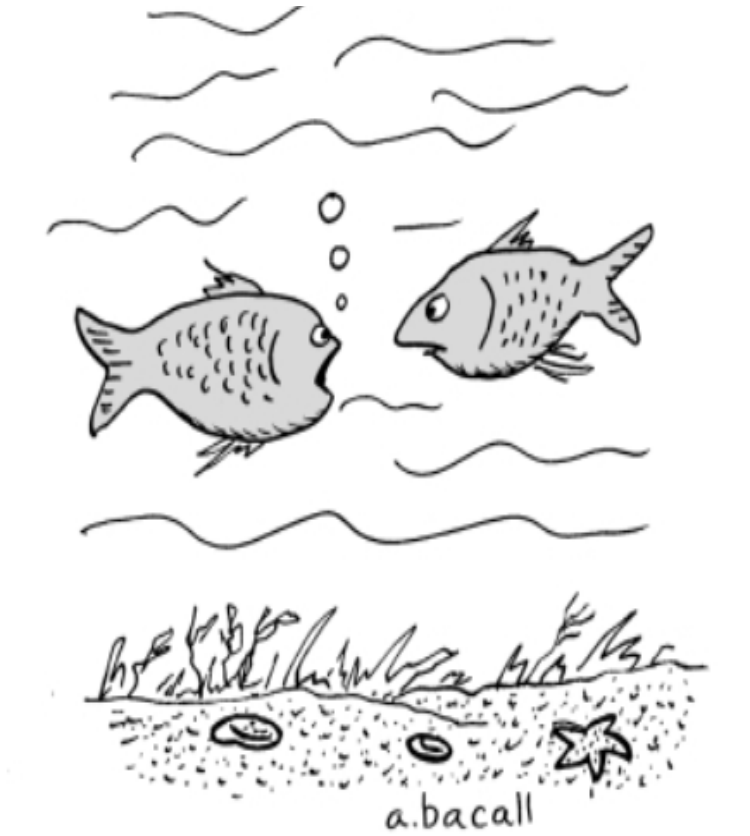

98.3
Start
153
114
S
M


Subclavian Artery
Axillary Artery
Brachial Artery
Radial Artery
Ulnar Artery

Hypertension

- Blood pressures consistently above the normal levels constitute a condition called hypertension, commonly known as high blood pressure.
- Hypertension can be caused by a variety of medical or lifestyle conditions. (ex. kidney disease or high sodium diet)

- Often called "the silent killer" because it usually does not show any recognizable symptoms until a serious event, such as a heart attack or stroke, occurs.
- Hypertension is dangerous because it forces the heart to work harder to pump blood around the body.



"I'm sure if I moved to a fresh water environment, my hypertension would abate."