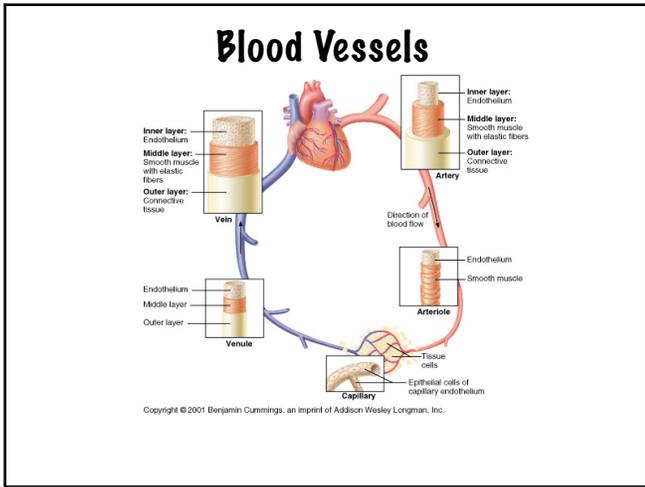


19 Blood Vessels



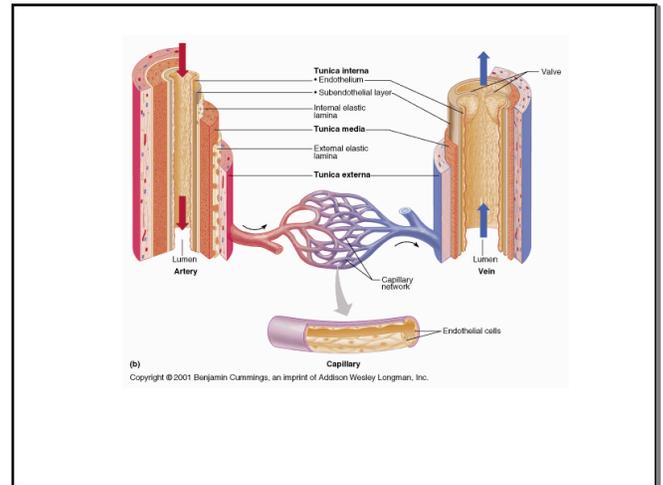
Overview

- 3 types of blood vessels
 - arteries - carry blood away from heart
"branch", "diverge", and "fork"
 - veins - carry blood toward heart
"join", "merge", and "converge"
 - capillaries - site of gas exchange
- arteries → arterioles → capillaries → venules → veins
- almost all arteries carry oxygen-rich blood
EXCEPTION: pulmonary artery (oxygen-poor blood)
- almost all veins carry oxygen-poor blood
EXCEPTION: pulmonary veins (oxygen-rich blood)

We have about 60,000 miles of blood vessels!

Structure of Blood Vessel Walls

- lumen - blood-containing space
- tunica interna (innermost)
 - simple squamous epithelium
 - minimizes friction as blood flows through lumen
- tunica media (middle)
 - smooth muscle
 - responsible for vasodilation and vasoconstriction
 - influences blood flow and blood pressure
 - thicker in arteries
- tunica externa (outermost)
 - collagen and elastin fibers, nerves, and blood vessels
 - protects and reinforces blood vessels, and anchors it to surrounding tissue



1 Vasodilation and vasoconstriction are caused by smooth muscle in the

- A lumen
- B tunica interna
- C tunica media
- D tunica externa

2 All arteries carry oxygenated blood away from the heart.

True

False

19 Blood Vessels

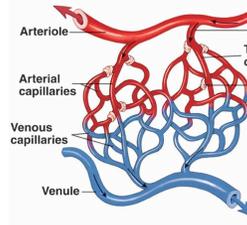
Arteries

- elastic (conducting)
 - aorta and its branches
 - large diameter (1-2.5 cm)
 - high in elastin
 - serve as pressure reservoirs
- muscular (distributing)
 - most of the named arteries
 - 1 cm (little finger) to 0.3 mm (pencil lead) in diameter
 - deliver blood to specific body organs
 - thick tunica media
- arterioles
 - smallest arteries (0.3 mm to 10 micrometers)
 - lead to capillary beds
 - determine blood flow to tissues

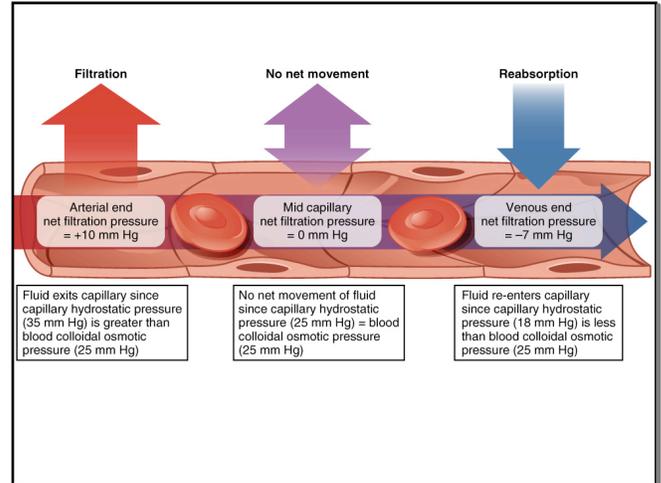
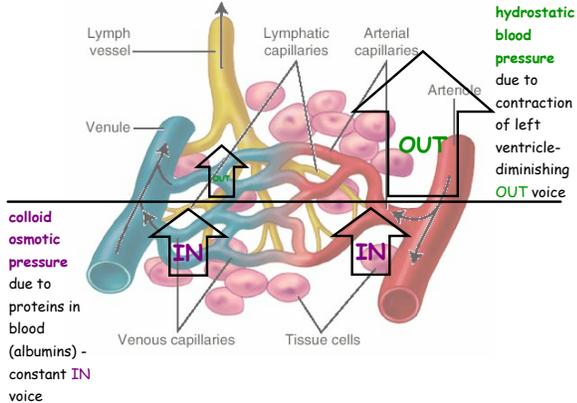


Capillaries

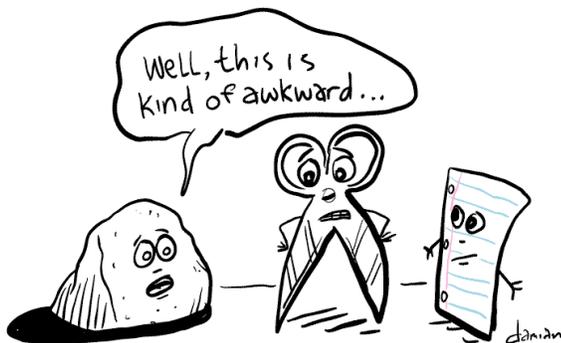
- consist only of tunica interna
 - just big enough for RBCs to pass through in single file
 - site of material exchange
 - capillary beds - interweaving network of capillaries (10-100)
 - connect arterioles to venules
- blood flow controlled by a precapillary sphincter allows blood to be rerouted during different activities



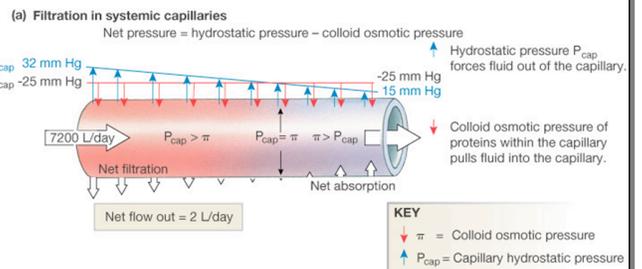
HOW DO CAPILLARIES EXCHANGE NUTRIENTS/WASTES?



BEST 2 OUT OF 3



WINNER...WHAT IS THE "IN" VOICE? HOW DOES IT CHANGE? NONWINNER...WHAT IS THE "OUT" VOICE? HOW DOES IT CHANGE?



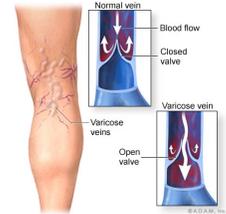
19 Blood Vessels

3 MATA: Fluid moves out of capillaries when the ___ is greater than the ___.

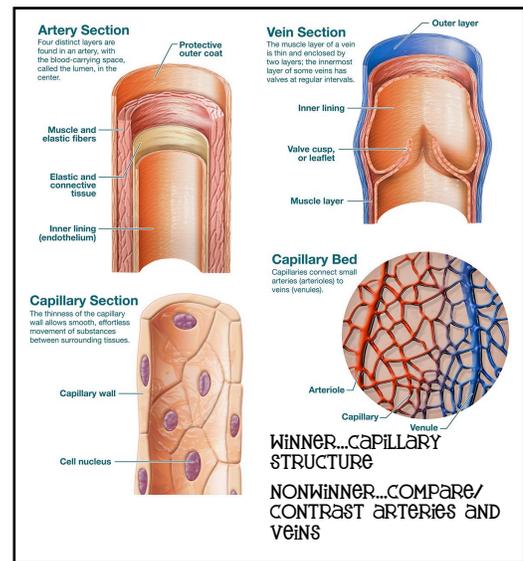
- A out voice, in voice
- B invoice, out voice
- C hydrostatic pressure, osmotic pressure
- D osmotic pressure, hydrostatic pressure

Venous System

- venules - small veins
- veins
 - thinner walls, but bigger lumens than arteries
 - serve as blood reservoirs (up to 65% of body's blood at any given time)
 - blood pressure low
 - rely on valves and skeletal muscle contraction to return blood to the heart
- varicose veins
 - weak and leaky valves cause blood to pool
 - ex. spider veins and hemorrhoids



Feeling lucky?...choose ODD OR EVEN



4 ___ are the site of nutrient exchange.

5 ___ have a larger lumen, but ___ have a thicker tunica media.

- A Veins, arteries
- B Veins, capillaries
- C Arteries, veins
- D Arteries, capillaries

19 Blood Vessels

Some Definitions

- blood flow - volume of blood flowing through a vessel, organ, or the entire circulation in a given time period (mL/min)
- blood pressure (BP) - force of blood against a blood vessel wall (mm Hg)
 - refers to systemic arterial BP (BP in major arteries near heart)
- peripheral resistance - opposition to flow
 - measures the amount of friction blood encounters as it passes through vessels
 - depends on...
 - blood viscosity - thickness or stickiness of blood (increase viscosity, increase resistance)
 - total blood vessel length - longer vessels have greater resistance
 - blood vessel diameter - smaller vessels have greater resistance (varies inversely with fourth power of the radius - $1/r^4$)

How are Flow, Blood Pressure, & Resistance Related?

$$F = \frac{\Delta P}{R}$$

- F = blood flow
 ΔP = difference in blood pressure between two points
R = peripheral resistance
- F is directly proportional to ΔP
 - when ΔP increases, blood flow speeds up (steep slide)
 - when ΔP decreases, blood flow slows down (shallow slide)
 - F is inversely proportional to R
 - when R increases, blood flow decreases
 - when R decreases, blood flow increases
 - R is more important than ΔP in determining blood flow (diameter constantly changes)

6 All of the following increase resistance EXCEPT

- A longer blood vessels
- B thick blood
- C vasodilation
- D small diameter

7 Blood flow depends on resistance and pressure differences.

- True
- False

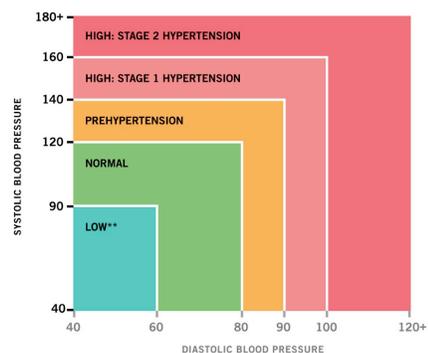
Blood Pressure

- a pressure gradient keeps blood flowing from higher (aorta) to lower (R atria) blood pressure
- measure arterial blood pressure
 - the pressure blood exerts against artery walls when the left ventricle contracts
 - systolic pressure = 120 mm Hg in healthy adults
 - arterial wall expand to accommodate blood
 - diastolic pressure = 80 mm Hg in healthy adults
 - arterial walls recoil in preparation for more blood
- BP is measured using a sphygmomanometer



Blood Pressure Chart*

vertex42



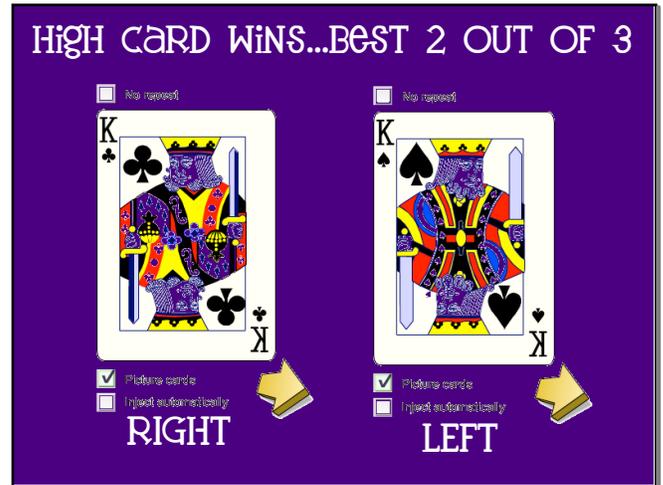
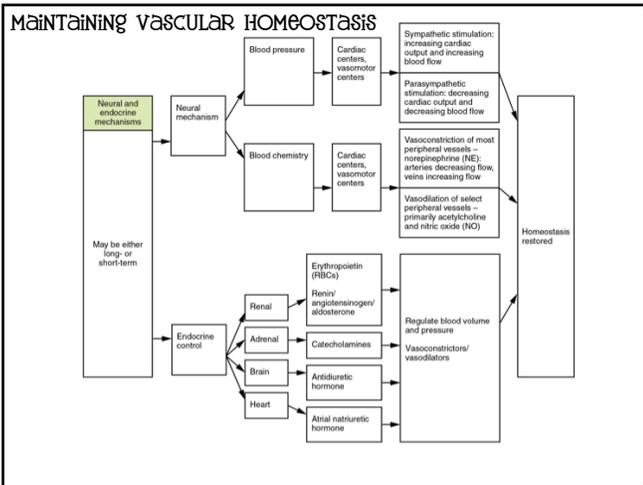
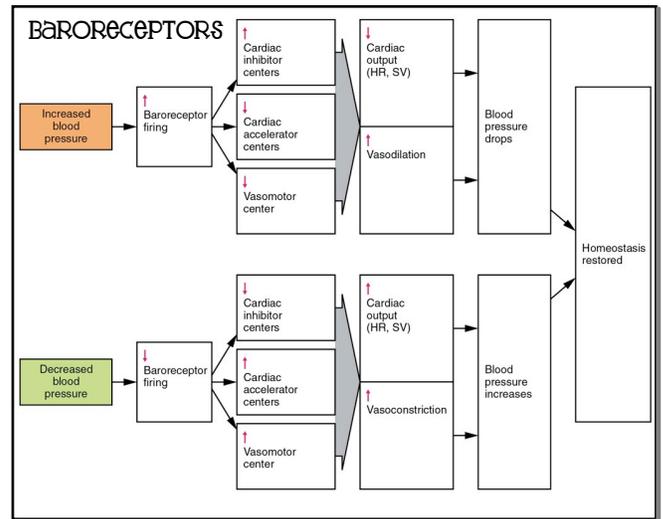
* The data used in this chart come from the "Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure" (<http://www.nhlbi.nih.gov/guidelines/hypertension/>).

** In general, having lower than normal (<20/90) blood pressure is a good thing, but you should consult your doctor or caregiver if you feel your blood pressure is too low and/or you are experiencing symptoms of [hypotension](#).

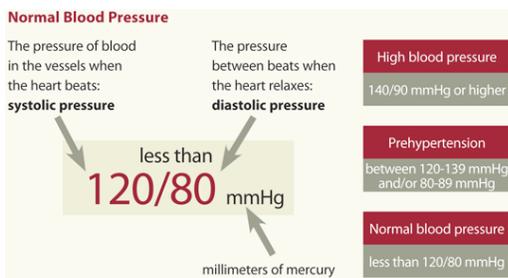
19 Blood Vessels

Maintaining Blood Pressure

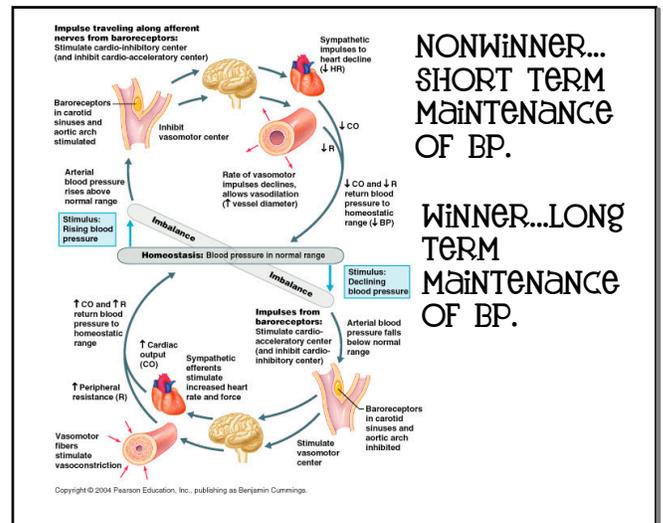
- factors that influence BP
 - cardiac output, peripheral resistance, and blood volume
- requires coordinated effort of brain, heart, blood vessels, and kidneys
- neural control of BP - short term
 - vasomotor center (medulla) - controls cardiac output and blood vessel diameter
 - baroreceptor-initiated reflexes - respond to stretch and cause vasodilation (lowers BP)
 - chemoreceptor-initiated reflexes - respond to increases in carbon dioxide and cause vasoconstriction (increase BP)
- kidney control of BP - long term
 - maintain BP homeostasis by regulating blood volume
 - too much fluid, BP rises
 - too little fluid, BP drops



WINNER...WHAT IS BLOOD PRESSURE?



NONWINNER...HOW IS IT MEASURED?



19 Blood Vessels

8 MATA: Blood pressure

- A measures systolic over diastolic pressure
- B is normal at 120/80 mm Hg
- C is a sign of cardiovascular health
- D measures the pressure of blood against an artery wall

9 MATA: Blood pressure is maintained by the

- A brain
- B heart
- C blood vessels
- D kidneys