Arteriole and Capillary

- Arteriole
- Smooth muscle cell
- Endothelium
- Capillary
Capillaries

Continuous

Fenestrated

Discontinuous
Capillary Permeability

- Tissue fluid
- Slit
- Endothelial cell
- Tissue fluid
- Capillary
Capillary Circulation

- Precapillary sphincter
- Arteriole
- Artery
- Capillaries
- Venule
- Vene

Blood flow

Metarteriole (forming arteriovenous shunt)
Capillary Pressure Gradients

Pressure inside capillary:
- Outward force, including hydrostatic pressure = 41.3 mm Hg
- Inward force of osmotic pressure = 28 mm Hg
- Net outward filtration pressure = 13.3 mm Hg

Pressure outside capillary:
- Outward force including hydrostatic pressure = 21.3 mm Hg
- Inward force of osmotic pressure = 28 mm Hg
- Net inward osmotic pressure = 6.7 mm Hg

Blood flow:
- From arteriole
- To venule

Tissue cells:
- RBC
- Ammonia and carbon dioxide
- Water, oxygen, and glucose
Capillary Pressure Gradients

Pressure inside capillary
Outward force, including hydrostatic pressure = 41.3 mm Hg
Inward force of osmotic pressure = 28 mm Hg
Net outward filtration pressure = 13.3 mm Hg
Blood flow = 13.3 mm Hg
From arteriole

Pressure outside capillary
Outward force including hydrostatic pressure = 21.3 mm Hg
Inward force of osmotic pressure = 28 mm Hg
Net inward osmotic pressure = 6.7 mm Hg

To venule
Blood flow

Ammonia and carbon dioxide
RBC
Water, oxygen, and glucose
Tissue cells
Venous Blood Flow

- Relaxed skeletal muscle
- Vein
- Valve open
- Contracted skeletal muscle
- Vein
- Valve closed

To heart
Circulatory Physiology

• Blood Flow

• Blood Pressure
  – Typically refers to systemic arterial pressure of largest arteries near heart

• Resistance
  – Viscosity
  – Total vessel length
  – Vessel diameter
Blood Pressure Graph

- **Systolic pressure**
- **Diastolic pressure**

Systemic blood pressure (mm Hg)

Distance from left ventricle

- Aorta
- Large arteries
- Small arteries
- Arterioles
- Capillaries
- Venules
- Small veins
- Large veins
- Vena cava
Arterial Blood Pressure Factors

- Blood volume increases
- Heart rate increases
- Stroke volume increases

Blood pressure increases

- Blood viscosity increases
- Peripheral resistance increases
Blood Pressure Regulation I

Cardiac output increases

Blood pressure rises

Baroreceptors in aortic arch and carotid sinuses are stimulated

Sensory impulses to cardiac center

Parasympathetic impulses to heart

Blood pressure returns toward normal

Heart rate decreases

S-A node inhibited
Rising blood pressure 

Stimulation of baroreceptors in aortic arch and carotid sinuses 

Sensory impulses to vasomotor center 

Vasomotor center inhibited 

Blood pressure returns toward normal 

Decreased peripheral resistance 

Vasodilation of arterioles 

Less frequent sympathetic impulses to arteriole walls 

Blood Pressure Regulation II
Circulation Paths

Systemic circuit

Pulmonary circuit

Systemic circuit

Head and upper limbs

Lungs

Heart

Digestive tract

Kidneys

Trunk and lower limbs
Blood Vessels of the Heart (1)

- Right common carotid a.
- Right subclavian a.
- Brachiocephalic a.
- Left common carotid a.
- Left subclavian a.
- Aortic arch
- Ligamentum arteriosum
- Right pulmonary a.
- Left pulmonary a.
- Left auricle
- Right auricle
- Pulmonary trunk
Arterial System (2)

- Brachiocephalic a.
- Axillary a.
- Deep brachial a.
- Brachial a.
- Radial a.
- Ulnar a.
- Femoral a.
- Popliteal a.
- Anterior tibial a.
- Peroneal a.
- Dorsal pedis a.
- Posterior tibial a.
Abdominal Aorta Branches

- Celiac a.
- Hepatic a.
- Right gastric a.
- Suprarenal a.
- Renal a.
- Gonadal a.
- Lumbar a.
- Middle sacral a.
- Abdominal aorta
- Phrenic a.
- Splenic a.
- Left gastric a.
- Superior mesenteric a.
- Inferior mesenteric a.
- Common iliac a.
Arteries of the Head and Neck (1)

- Superficial temporal a.
- Posterior auricular a.
- Basilar a.
- Occipital a.
- Internal carotid a.
- External carotid a.
- Carotid sinus
- Vertebral a.
- Thyrocervical axis
- Subclavian a.
Circle of Willis

Cerebral arteries:
- Anterior cerebral a.
- Middle cerebral a.
- Posterior cerebral a.
- Basilar a.
- Vertebral a.

Anterior communicating a.
- Internal carotid a.
- Pituitary gland
- Basilar a.
Right common carotic a.
Right subclavian a.
Axillary a.
Anterior circumflex a.
Posterior circumflex a.
Deep brachial a.
Brachial a.

Arteries of the Shoulder and Arm (1)
Arteries of the Thoracic Wall

- Vertebral body
- Posterior intercostal artery
- Internal intercostal muscle
- Internal thoracic artery
- Thoracic aorta
- External intercostal muscle
- Sternum
- Anterior intercostal artery
- Costal cartilage
Arteries of the Leg and Pelvis (1)
Brachiocephalic v.
Axillary v.
Cephalic v.
Brachial v.
Basilic v.
Median cubital v.
Radial v.
Ulnar v.

Femoral v.
Popliteal v.
Peroneal v.
Posterior tibial v.
Small saphenous v.
Anterior tibial v.

Great saphenous v.

Venous System (2)
Veins of the Head and Neck

- Venous sinuses
- Superior ophthalmic v.
- Vertebral v.
- Right external jugular v.
- Anterior facial v.
- Internal jugular v.
- Right subclavian v.
- Right axillary v.
- Right brachiocephalic v.
Veins of the Arm and Shoulder (1)

- Right internal jugular v.
- Right external jugular v.
- Right subclavian v.
- Right brachiocephalic v.
- Axillary v.
- Brachial v.
- Cephalic v.
- Basilic v.
Veins of the Thoracic Wall

- External jugular v.
- Subclavian v.
- Superior vena cava
- Axillary v.
- Brachial v.
- Basilic v.
- Azygos v.
- Internal jugular v.
- Brachiocephalic v.
- Cephalic v.
- Superior hemiazygos v.
- Posterior intercostal v.
- Inferior hemiazygos v.
Veins of the Leg and Pelvis (1)

- Right common iliac v.
- External iliac v.
- Inferior vena cava
- Internal iliac v.
- Femoral v.
- Great saphenous v.
- Popliteal v.

Anterior view

Posterior view