Cardiovascular Dynamics

The Heart
- aorta
- pulmonary artery
- pulmonary veins
- left atrium
- left ventricle
- superior vena cava
- pulmonary artery
- pulmonary veins
- right atrium
- right ventricle
- inferior vena cava

Heart Valves
- pulmonary semilunar valve
- aortic semilunar valve
- tricuspid valve
- bicuspid valve

Blood Flow Through the Heart
### Contraction Cycle of the Heart

1. **Atrial and Ventricular Diastole**
   - AV valves open
   - Semilunar valves closed

2. **Atrial Systole, Ventricular Diastole**
   - AV valves open
   - Semilunar valves closed

### Blood Vessel Structure
- Simple squamous epithelium
- Smooth muscle tissue
- Connective tissue

### Arteries
- Carry blood away from the heart.
- Thick-walled to withstand hydrostatic pressure of the blood during ventricular systole.
- Blood pressure pushes blood through arteries.

### Veins
- Carry blood to the heart.
- Thinner-walled than arteries.
- Possess one-way valves that prevent backwards flow of blood.
- Blood flow due to body movements, not from blood pressure.
One-Way Valves in Veins

Schematic of Circulatory System

Systemic Circuit
Pulmonary Circuit
Heart

Mechanics of Circulation

Some Definitions
Blood Flow
Blood Pressure
Peripheral Resistance
Blood Viscosity

Factor Influencing Peripheral Resistance
Blood Viscosity
Vessel Radius
Vessel Length
Poiseuille’s Equation

\[ \text{Blood Flow (}\Delta Q\text{)} = \frac{\pi \Delta P r^4}{8\eta l} \]

\( \Delta P \) = pressure difference

\( r \) = vessel radius

\( \eta \) = blood viscosity

\( l \) = vessel length

\( \pi \approx 3.14 \)
Pump Mechanics

Some Definitions

- End Diastolic Volume (EDV)
- End Systolic Volume (ESV)
- Cardiac Output
- Stroke Volume \( (SV = EDV - ESV) \)