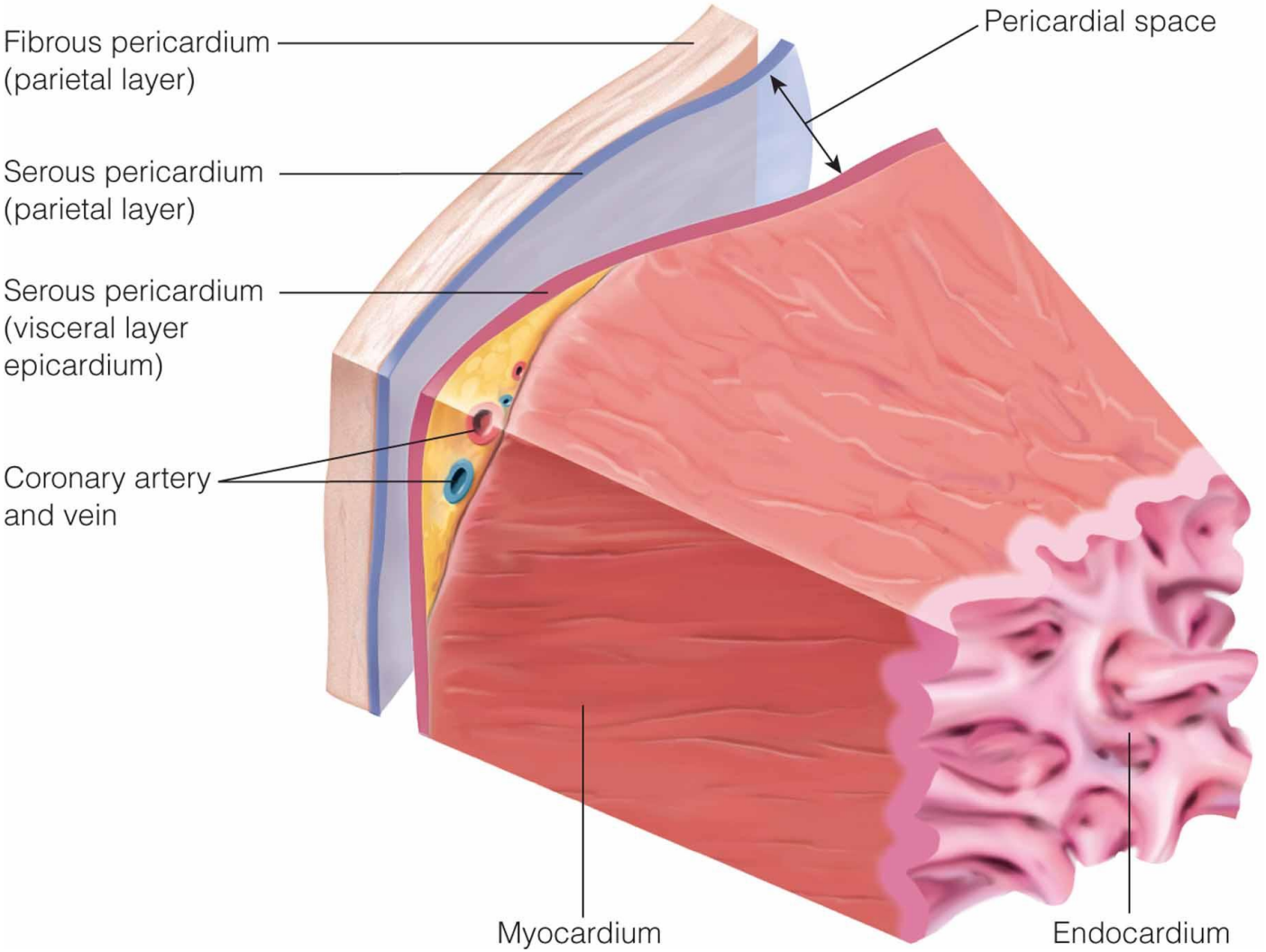
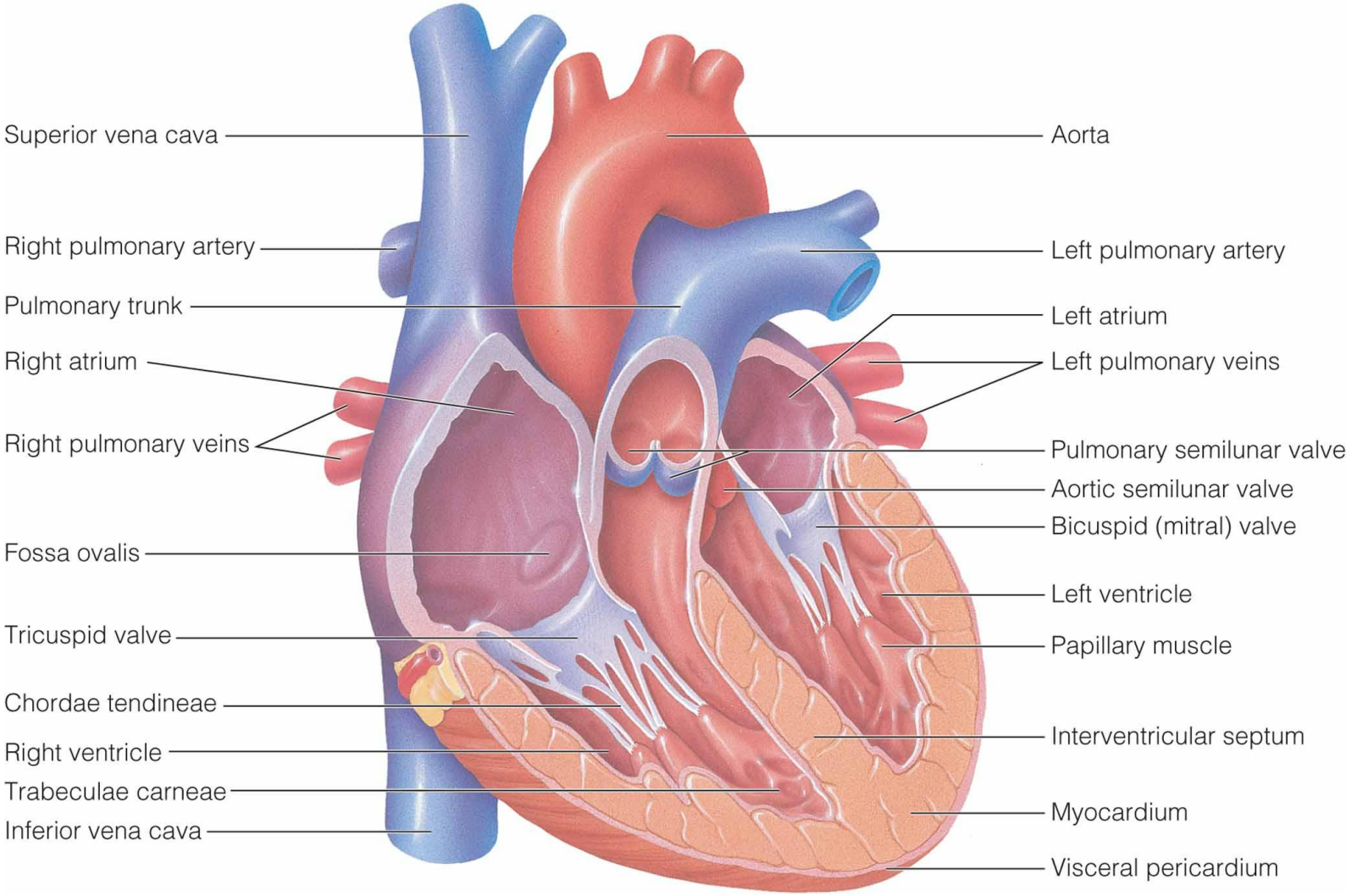
Heart

- Pericardium
- Cardiac muscle
- Chambers
- Valves
- Cardiac vessels
- Conduction system

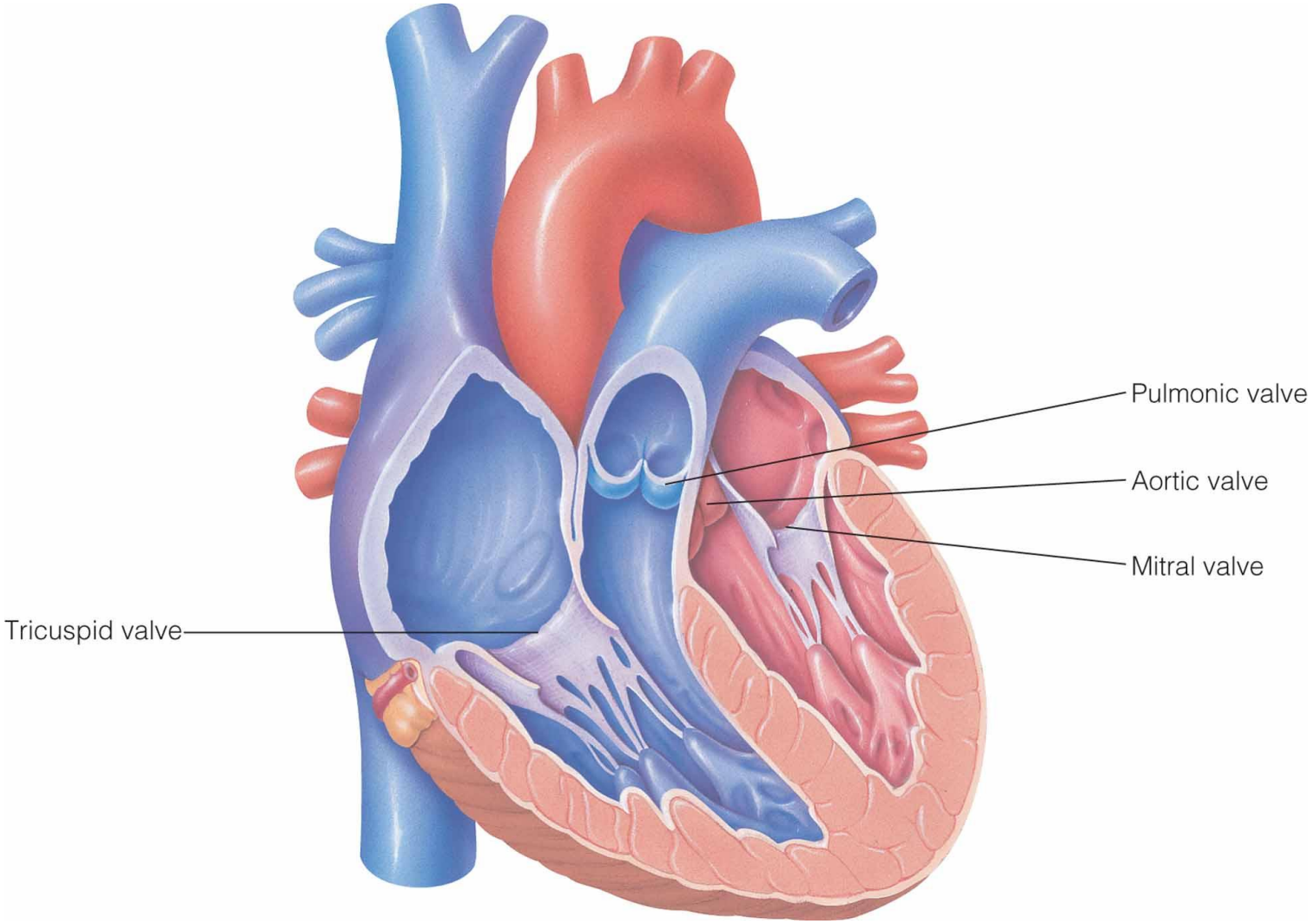
Layers of the heart.



Structural components of the heart



Valves of the heart



Pericardium

- Thin Sac Composed of Fibroserous Material That Surrounds the Heart
- Outer layer
- Inner layer
- Fluid between the layers

Heart Muscle

- Base
- Apex
- Epicardium
- Myocardium
- Endocardium

Chambers in the Heart

- Left and right atria
- Left and right ventricles

Valves

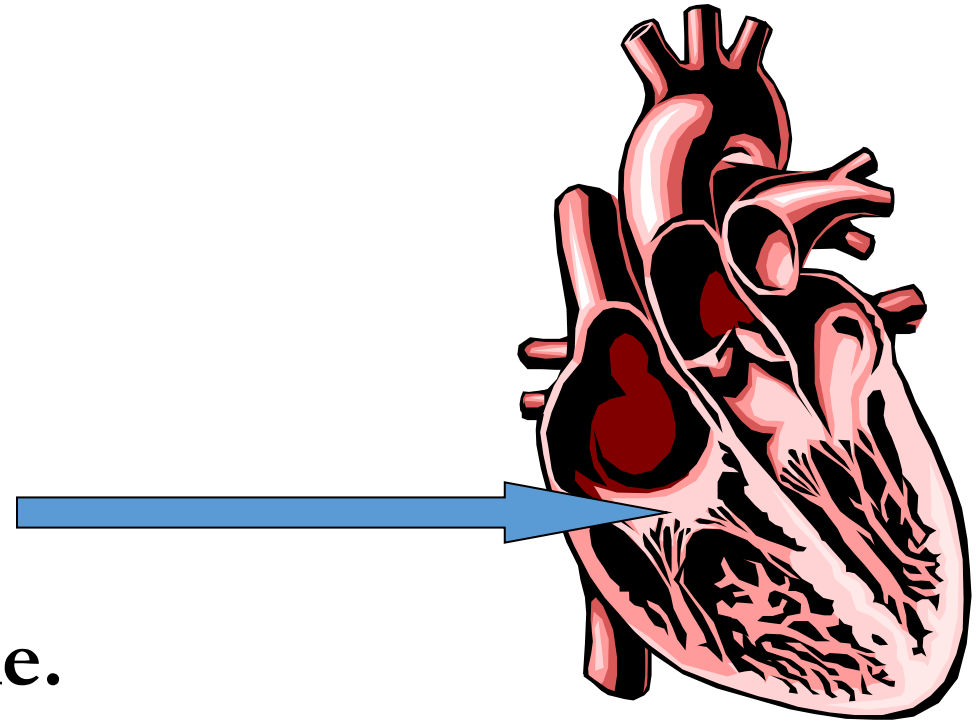
- Permit the Flow of Blood Between Chambers and Into Blood Vessels
- Atrioventricular (AV)
  - Tricuspid
  - Mitral
- Semilunar
  - Pulmonary
  - Aortic

Heart Sounds

- S_1
- S_2

S1

S1 - Closure of mitral and tricuspid valves



- Beginning of systole.
  - (think of the heart starting to contract – what is happening ?)
- Relates to QRS complex.
- Generally described as the “lub”.

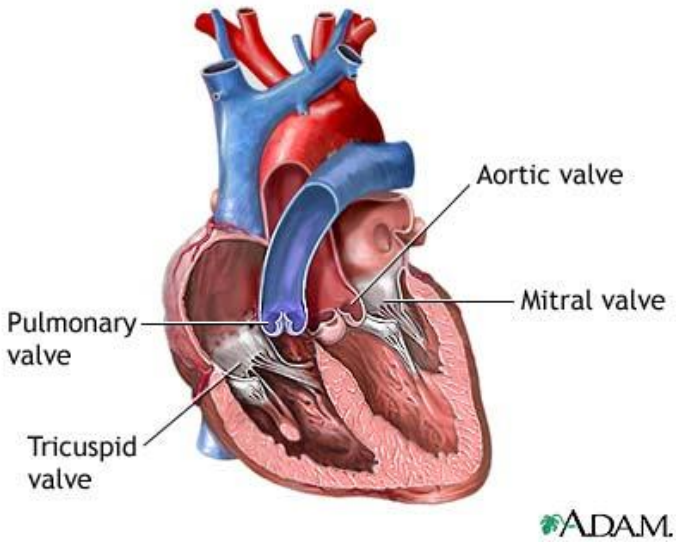
What does it mean?

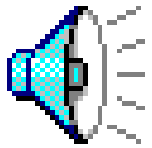
- **S1 - Closure of mitral and tricuspid valves.**
- **Beginning of systole.**
- **Listen with the diaphragm.**
- **Best heard over Apex –**

  but can be heard over entire

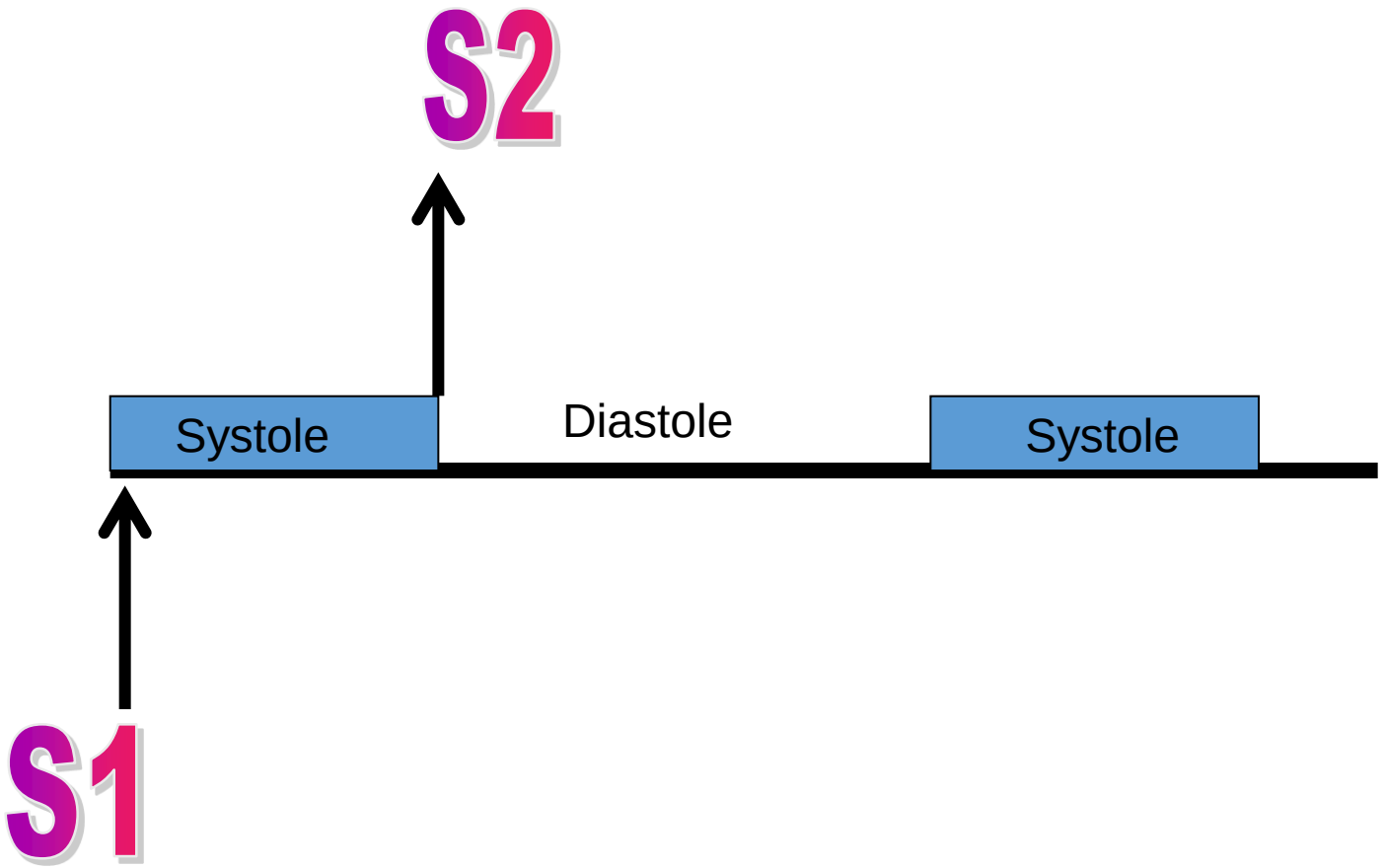
Precordium.

- **Can hear it in any position.**





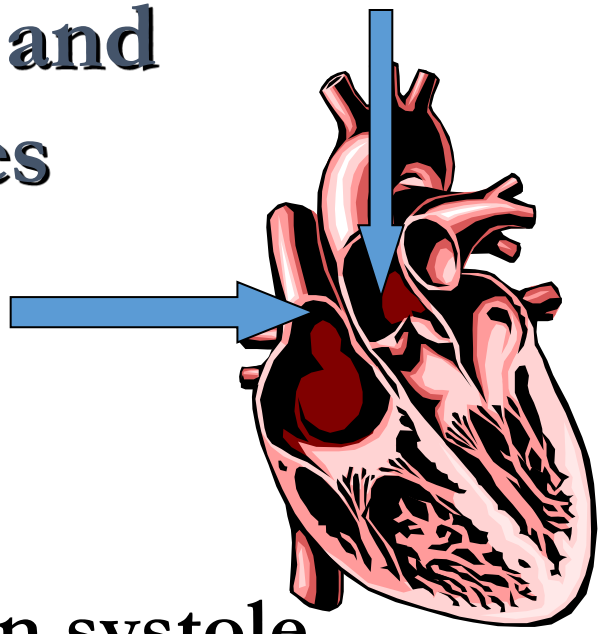
Lub Dub



Diastole

- **Filling of the ventricles with blood.**
- **At this time the atrioventricular valves must be open but the pulmonic and aortic must close.**
- **Diastole – in two parts – early and late.**

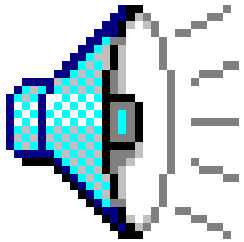
S2 - Closure of aortic and pulmonic valves



- Beginning of diastole.
- Diastole is generally longer than systole.
- Generally described as the “dub”.
- Heard over entire precordium - best at base.
- Shorter, higher pitched than S1.

How does it sound ?

S2 - Closure of aortic and pulmonic valves.

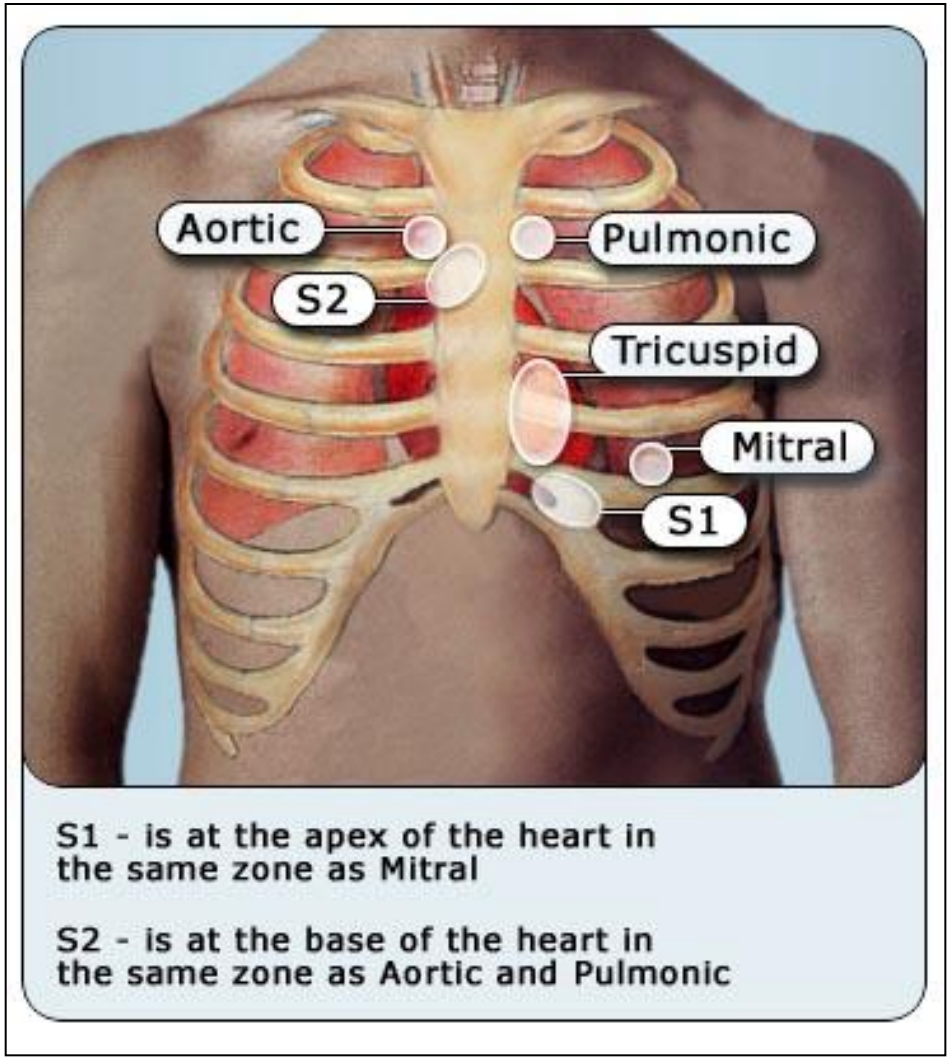


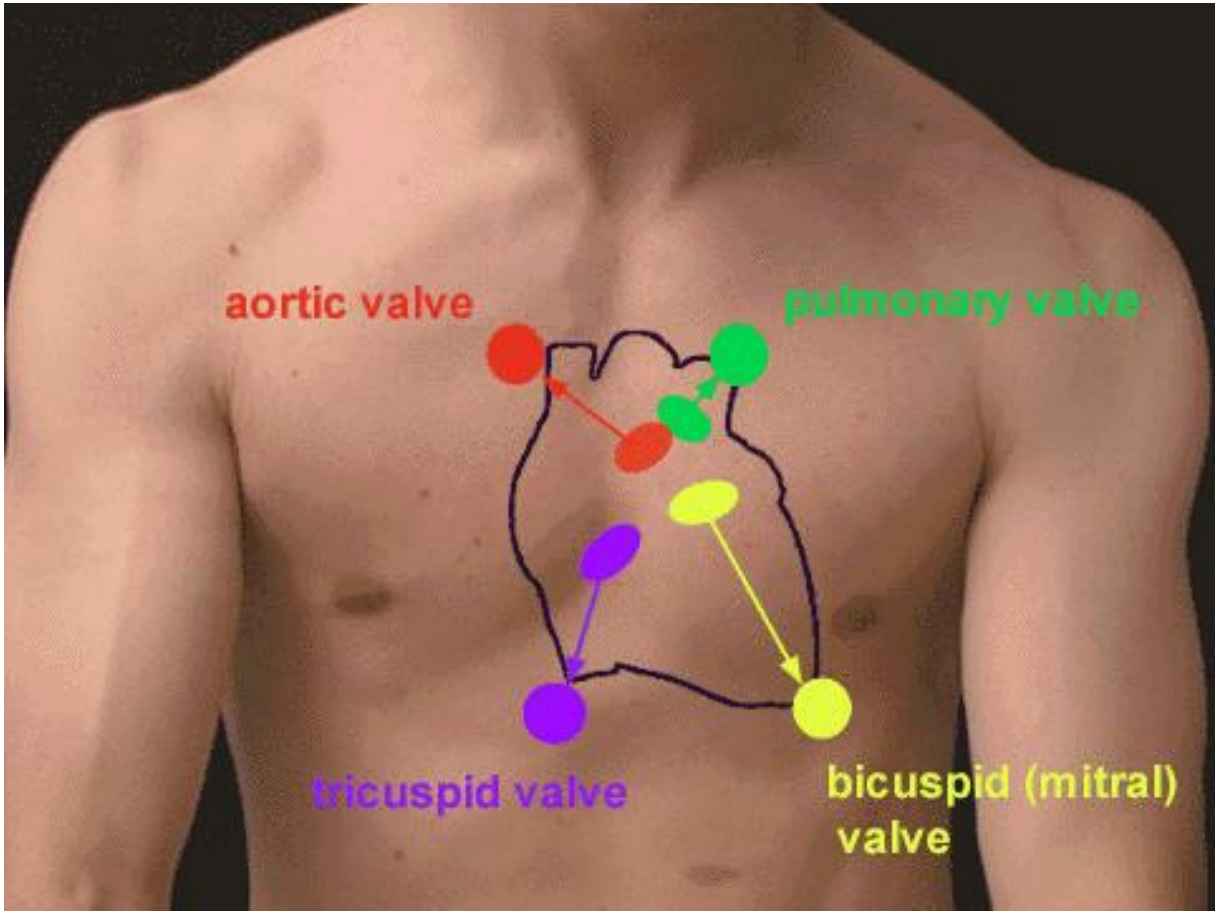
- May be split - normal - changes with inspiration.
- Instead of a clean “dub” you may hear “T-dub”.
- Split S2 - only heard in Pulmonic valve area.

HEART SOUNDS

Sites:

- **AORTIC**
- **PULMONIC**
- **ERB'S POINT**
- **TRICUSPID**
- **MITRAL**

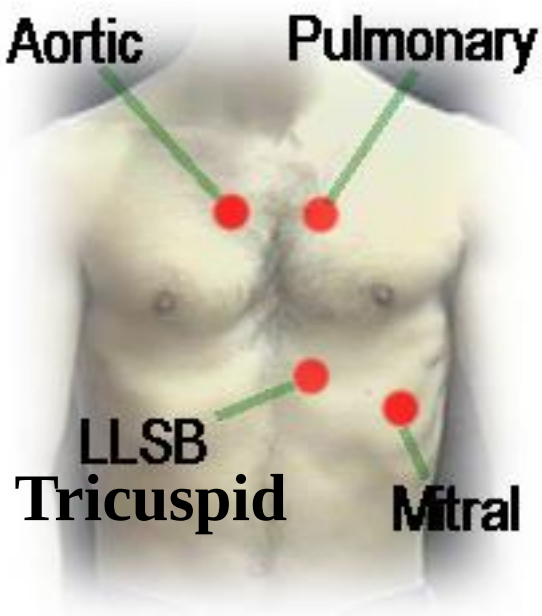




(http://www.med.umich.edu/lrc/coursepages/M1/anatomy/html/surface/thorax/hsounds.htm)l

Aortic Valve Area

Pulmonic Valve Area



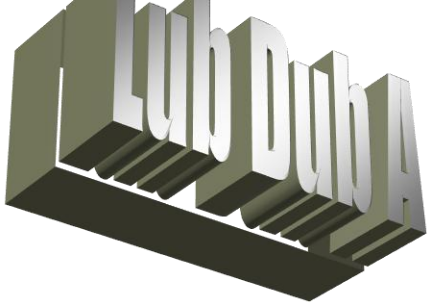
Tricuspid Valve Area

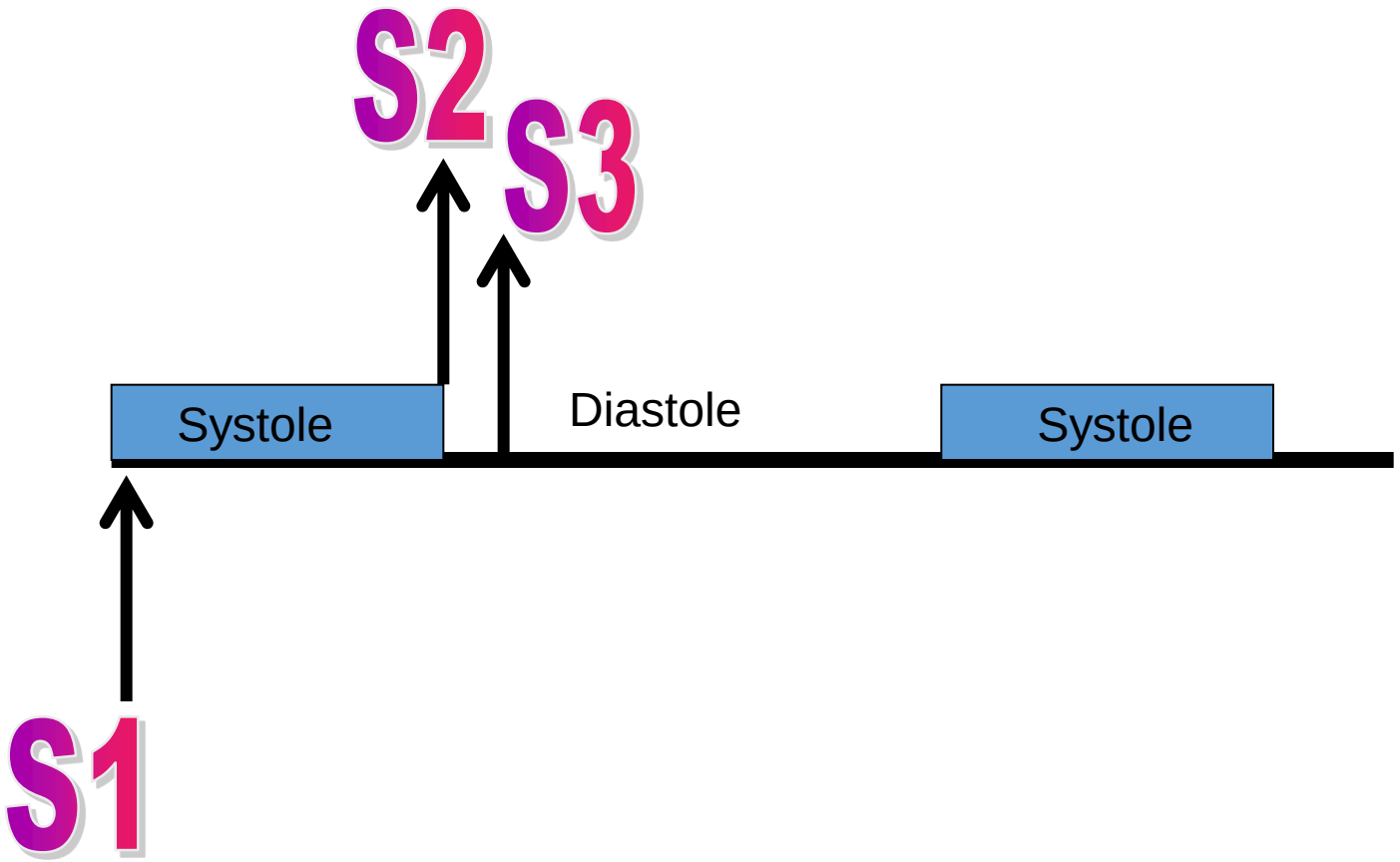
Mitral Valve Area

Abnormal Heart Sounds

S3

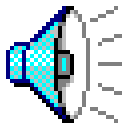
- **First clinical sign of congestive cardiac failure**
- **Occurs early in diastole.**
- **Occurs in a dilated ventricle and results from the rapid flow of blood into non pliable ventricles.**
- **Filling of ventricles with limited distensibility.**
- **The ventricles are resisting the filling because they are already congested because of the failure.**

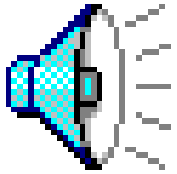

Lub Dub


S2
S3
Systole
Diastole
Systole
S1

Abnormal Heart Sounds

- **S3 sounds like Lub Dub A**
- **Ventricular gallop**
  - Main cause: heart failure, volume overload.
  - Can also be caused by hypertension.
  - Some valve problems:



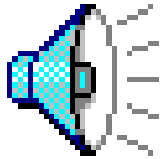


  - Mitral, aortic or tricuspid insufficiency.
  - Use the bell in mitral area as is low pitched.
  - May be normal in children and young adults.

normal

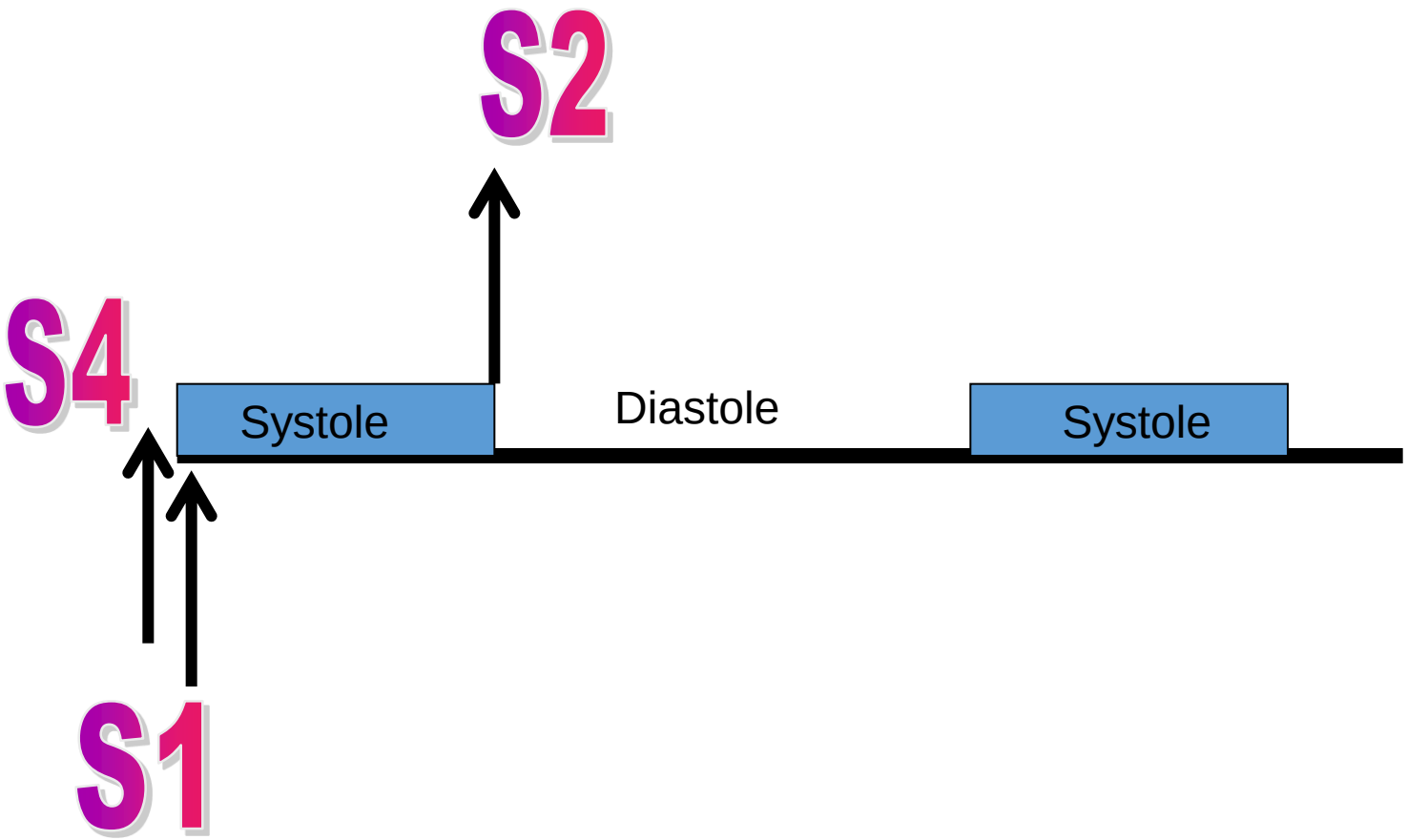
Abnormal Heart Sounds

- **S4 - atrial gallop**
- **Associated with the atrial kick - late diastole.**
- **Atrial contraction is more forceful than normal – trying to push against increasing resistance.**
- **Implies decreased compliance or a stiff left ventricle.**



Heard in:

- **Myocardial infarction in a large infarct .**
  - **A slightly damaged noncompliant left ventricle can accommodate the blood that enters through the initial filling phase.**
  - **However it can't accommodate the blood at end of diastole – S4**


S2
S4
Systole
Diastole
Systole
S1

How do they sound ?

S3

- **Sound of a stone dropping into the water at the bottom of the well, dull and thuddy.**

S4

- **Hollow, snappy sound.**

- **Don’t always expect to hear two distinct sounds, gallops often sound as mere distortions of the normal heart. Abnormal sounds low pitched can be hard to hear….don’t be discouraged if learning and can’t initially hear.**

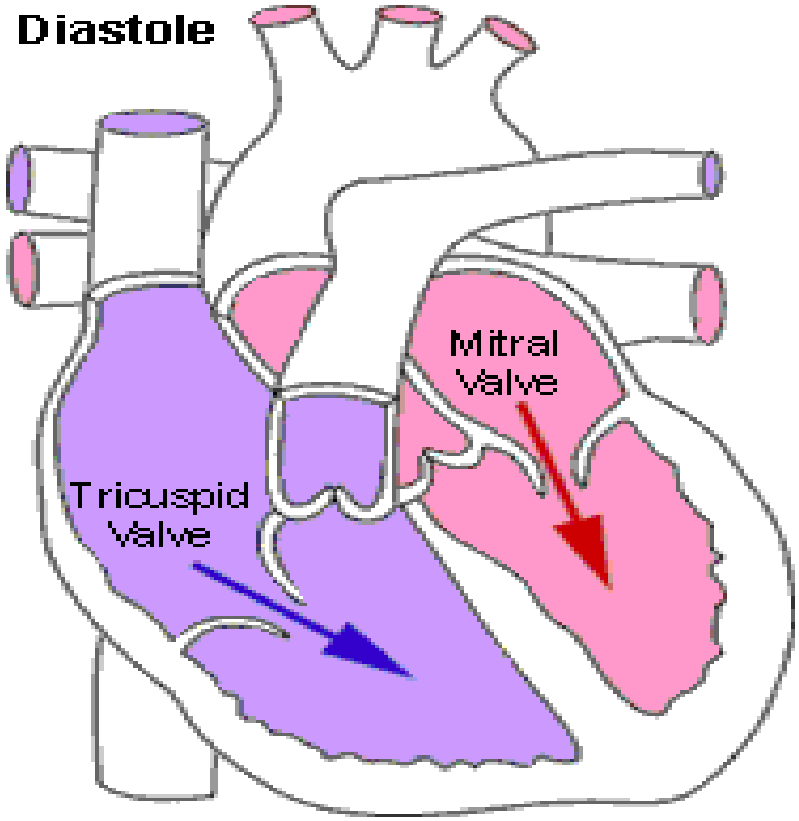
Murmurs

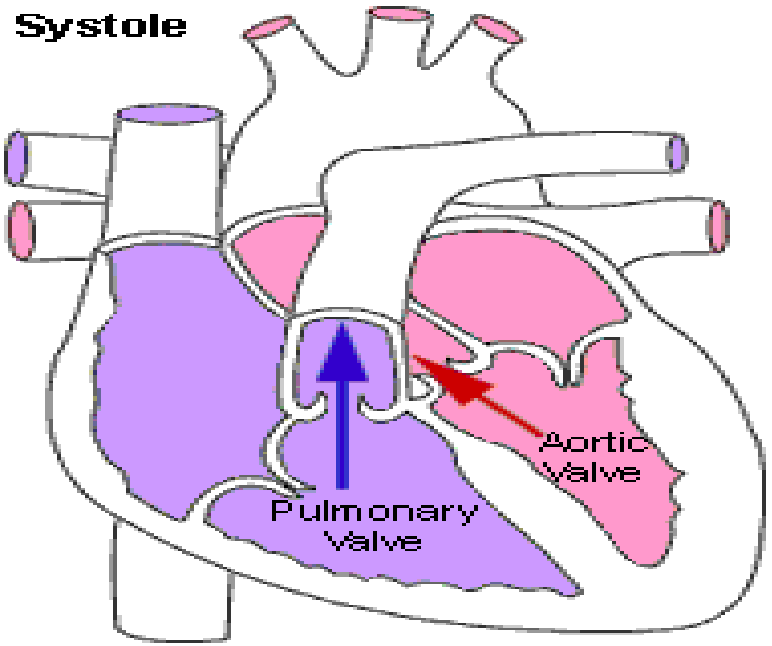
- **Any reason that causes a turbulence in blood flow, or any alteration in movement of blood.**
- **The movement of blood is significantly altered when there is leakage through insufficient valves or turburlence across a narrowed outlet as with stenosis:**

Valves:

- **Stenosis – turbulence across narrow outlet (stiff).**
- **Regurgitation – (leaking).**

Defects in the heart.



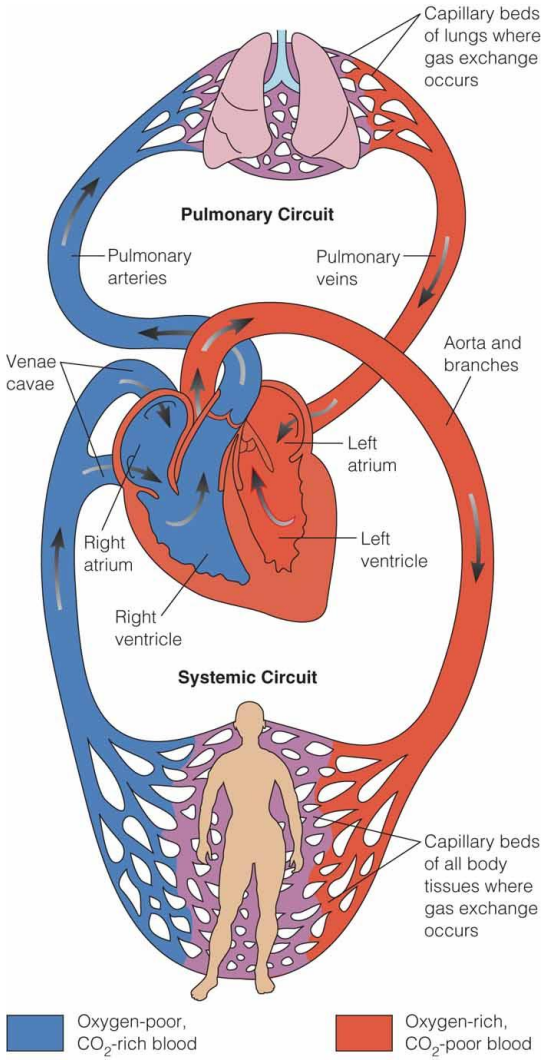


Aortic stenosis is a heart valve disorder that narrows or obstructs the aortic valve opening. Narrowing of the aortic valve prevents the valve from opening properly and obstructs the flow of blood from the left ventricle to the aorta.

Contraction and Relaxation Phases of the Heart

- Systole
- Diastole

Figure 17.8 Pulmonary and systemic circulation. The left side of the heart pumps oxygenated blood (indicated in red) into the arteries of the systemic circulation, which provides oxygen and nutrients to the cells. Deoxygenated blood (indicated in blue) returns via the venous system into the right side of the heart, where it is transported to the pulmonary arterial system to be reoxygenated.



Circulation of the Heart

- Coronary arteries
  - Left main
  - Right coronary
  - Left anterior descending
  - Circumflex

Figure 17.6 Vessels of the heart. **A**. Anterior.

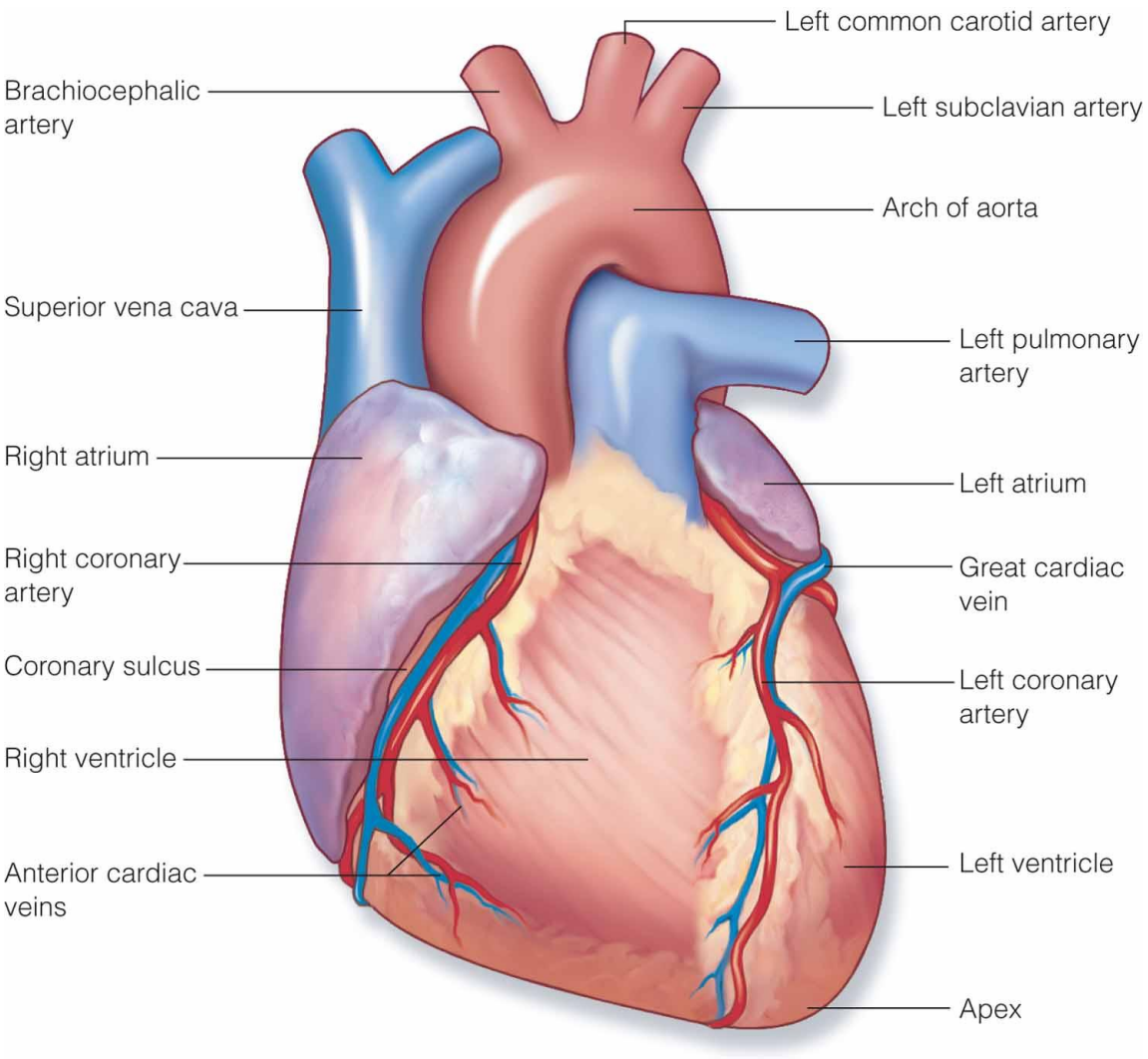
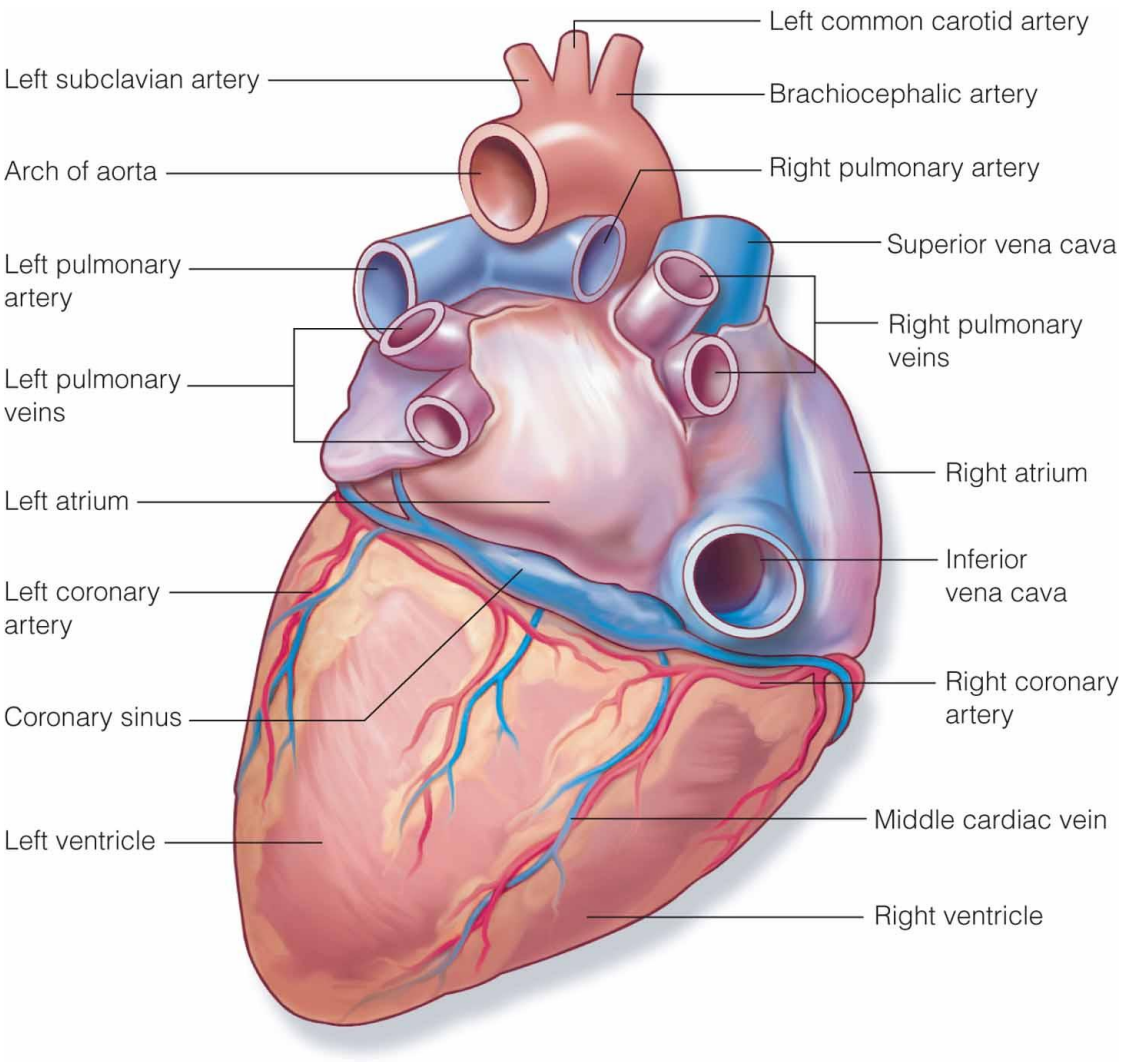


Figure 17.6 (continued) Vessels of the heart. **B**. Posterior.

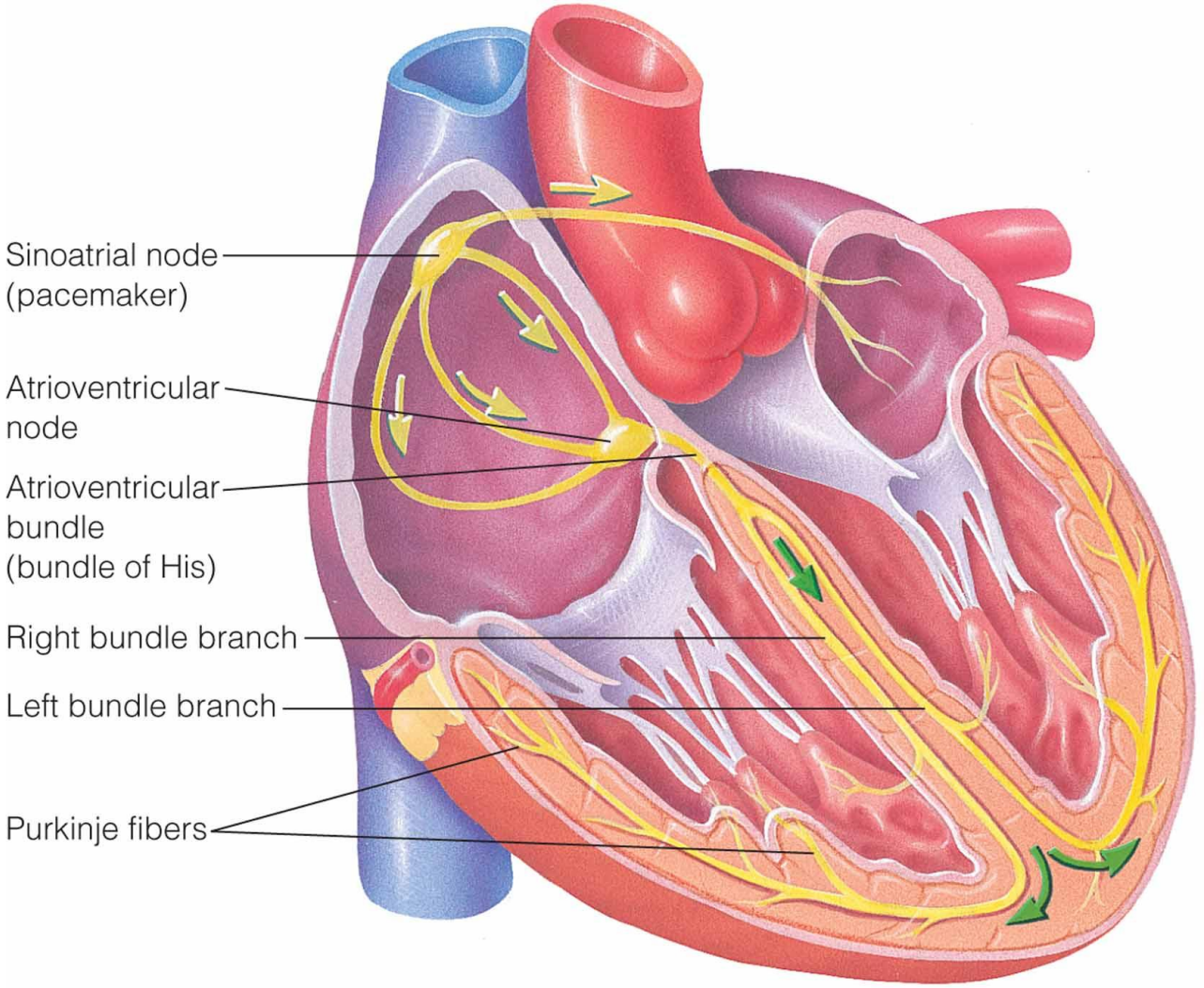


B

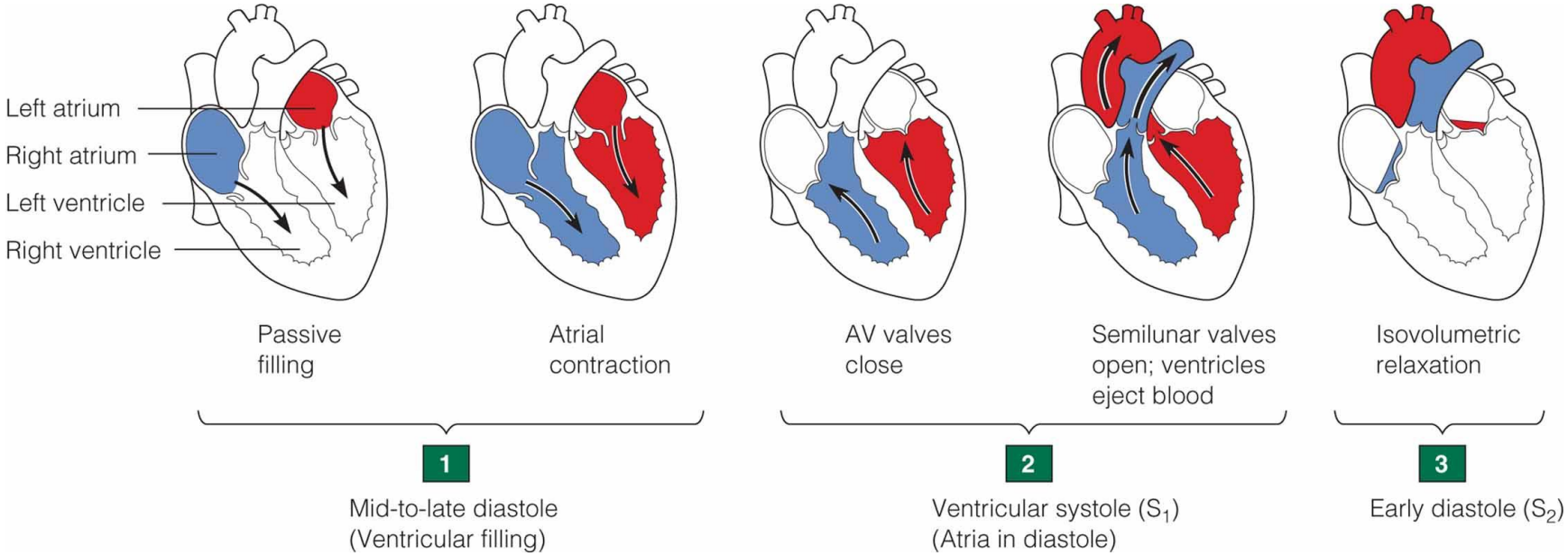
Conduction System of the Heart

- Sinoatrial (SA) node
- Intra-atrial pathways
- AV node
- Bundle of His
- Right and left bundle branches
- Purkinje fibers

Figure 17.7 Conduction system of the heart.



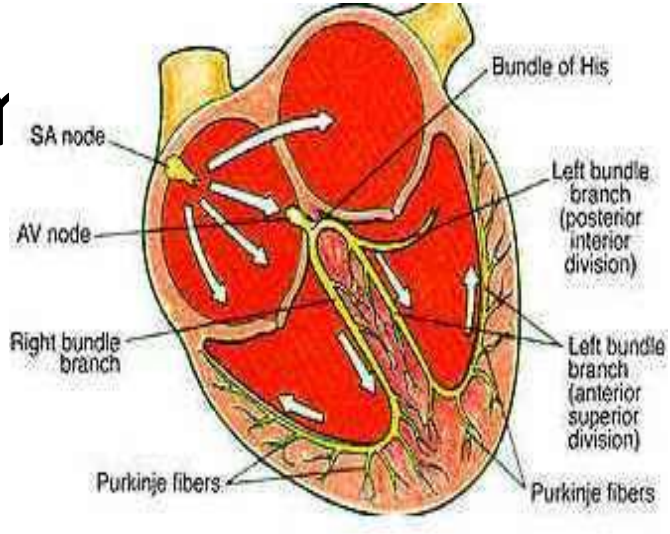
Cardiac Cycle: Contraction and Relaxation of the Chambers



Cardiac Cycle

- Ventricular filling
- Ventricular systole
- Isovolumetric relaxation

Electrocardiogram



- Paper Recording of Deflections That Represent the Cardiac Cycle
- Electrical deflections
  - *P* wave
  - *PR* interval
  - *QRS* interval
  - *T* wave

Electrocardiogram wave

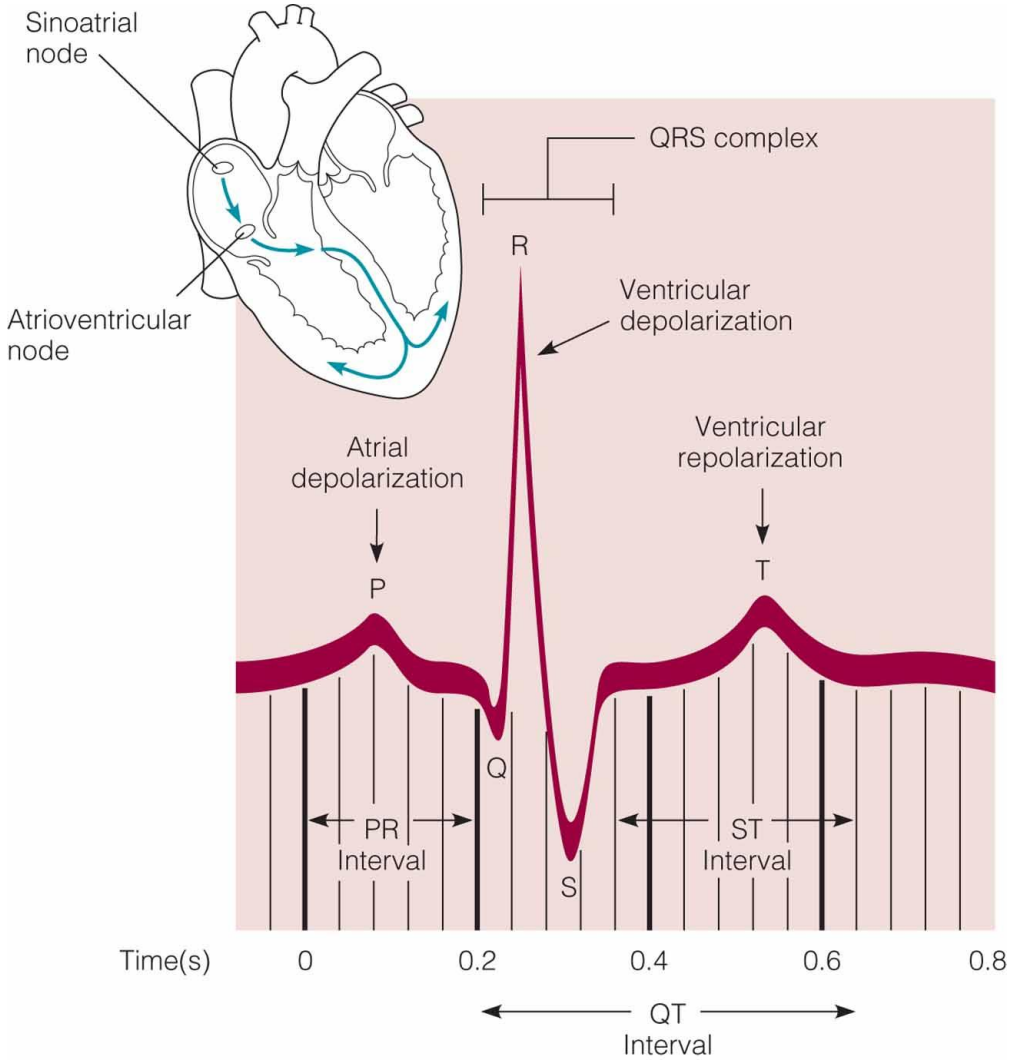
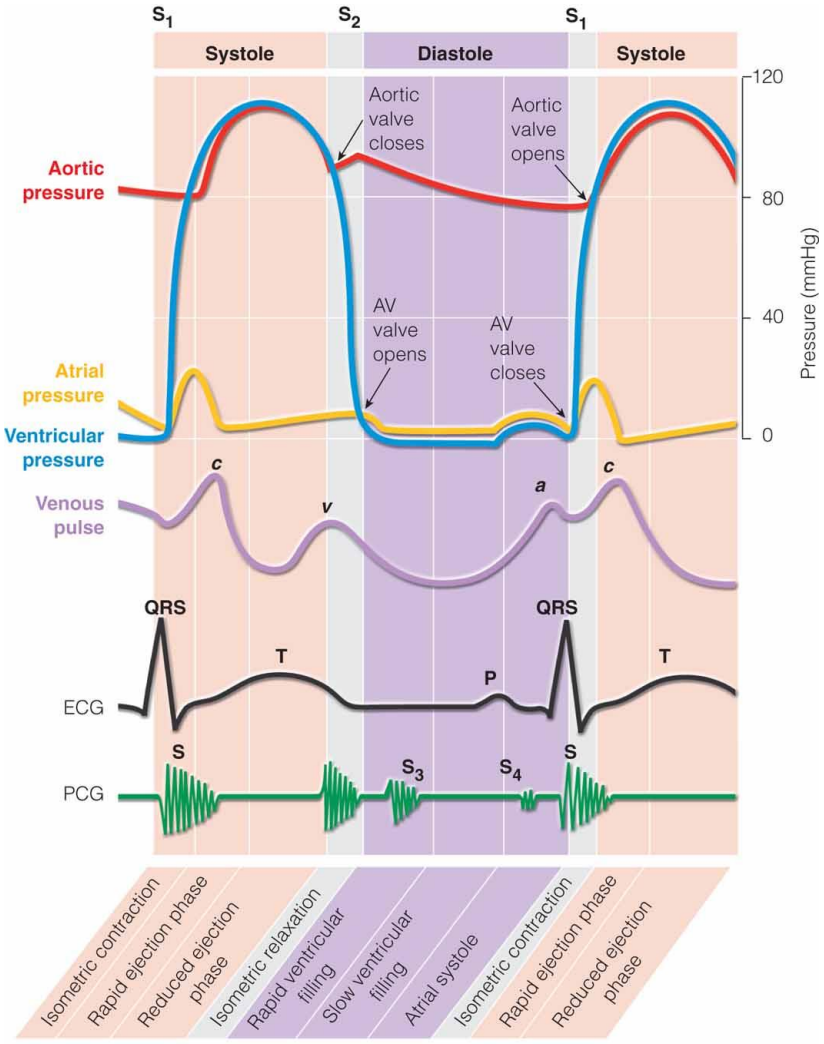


Figure 17.12 Events of the cardiac cycle.



Cardiac Function

- Stroke volume
  - Amount of blood that is ejected with each heartbeat
- Cardiac output
  - Amount of blood ejected from the left ventricle over 1 minute
- Cardiac index
  - Measurement accounting for an individual's weight when evaluating the pumping action of the heart