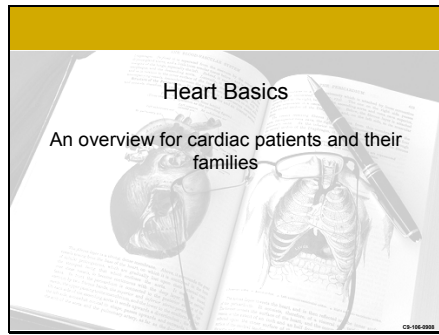


Heart Basics - Script

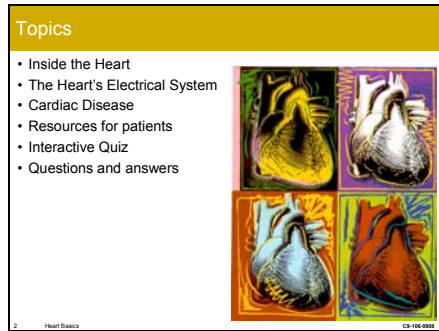
Slide 1



This presentation will review basic cardiac anatomy and function for the human heart and introduce you to cardiac disease. It also contains an interactive quiz at the end.

Information for this presentation comes from [www.bostonscientific.com/Intro to the Heart](http://www.bostonscientific.com/Intro%20to%20the%20Heart), accessed 090808 and "Device Therapy: Making a Difference", C9-068.

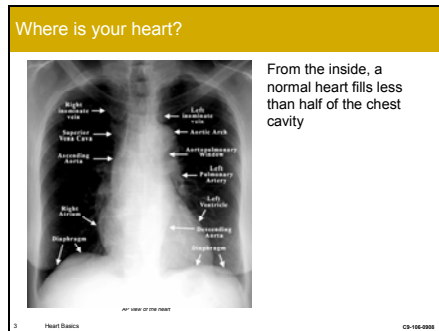
Slide 2



Did you give your friends valentines and little heart-shaped candies on Valentine's Day? Do you ever cross your heart when making a promise that you really, really mean? Or turn on the radio to hear a guy singing about his broken heart?

We see and hear about hearts everywhere. A long time ago, people even thought that their emotions came from their hearts, maybe because the heart beats faster when a person is scared or excited. Now we know that emotions come from the brain, and in this case, the brain tells the heart to speed up. So what's the heart up to, then? How does it keep busy? What does it look like? Let's find out.

Slide 3



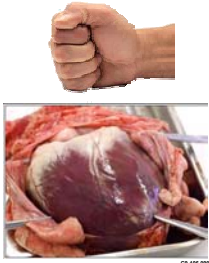
Your heart is a hollow organ in the center of your chest. Although you may feel your heart beat when you place your hand over it, your heart is not right under your skin. Instead, your heart is behind your breastbone, inside your ribcage, and between your lungs.

Heart Basics - Script

Slide 4

What does your heart look like?

- About the size of your fist.
- A muscular organ whose main purpose is to pump blood to all the tissues of the body.
- Weighs about the same as a can of soup (10.6 ounces).
- Creates enough pressure to squirt blood 30 feet.



Heart Basics CS-106-0001

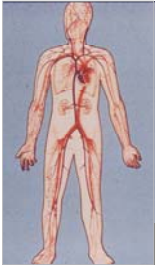
An average adult heart is about the shape and size of a closed fist. Like a valentine heart, yours is slightly pointed at the lower end. The pointed end is called the *apex*.

Your heart's walls are made mostly of strong muscle, called the myocardium. The myocardium is the strongest, hardest-working muscle in your body.

Slide 5

What does your heart do?

- The hardest working muscle in your body.
- In an average adult, about 5 quarts (4.7 liters) of blood flow through the heart each minute.
- There are 60,000 miles (96,560 kilometers) of blood vessels for a lifetime, without rest!



Heart Basics CS-106-0001

Although your heart is hollow, it isn't empty.

In an average adult, about 5 quarts (4.7 liters) of blood flow through the heart each minute. The main job of your heart is to pump that blood, which is full of oxygen and nutrients, through your entire body. Your organs (like your brain, kidneys, and liver) will stop working if they don't get oxygen and nutrients from blood.

It continuously pumps your blood through 60,000 miles (96,560 kilometers) of blood vessels for a lifetime, without rest!

The ability of the heart to pump about 5 L/min may not seem that amazing until you begin to recognize that it must do this continuously for 1440 minutes each day, and continue doing so, non-stop, each day of your life!

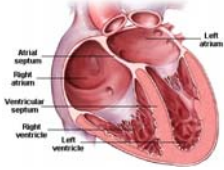
The bottom line is that the heart gives our body the opportunity to experience very effective exchange at the tissues!

Heart Basics - Script

Slide 6

Where does blood flow?

- You can think of your heart as having four different chambers or "rooms".
- Each "room" is connected by a valve, which is kind of like a door.
- Blood flows into the atria.
- Blood is pumped out of the ventricles.



Heart Basics CS-106-0001

The hollow center of your heart is divided into four sections, called *chambers*. Each chamber is like a separate room, with doors that let blood in and out.

You can compare it to a duplex apartment that is made up of a right and a left unit, separated from each other by a partition wall known as a *septum*.

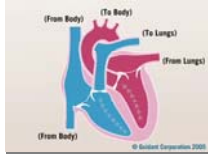
The two upper chambers in your heart are called the *atria*. The atria are the receiving chambers of your heart.

The two lower chambers in your heart are called *ventricles*. The ventricles are the pumping chambers of your heart. The ventricles are very strong because they have to pump hard enough to push blood through your lungs and entire body.

Slide 7

Blood flow through your heart

1. Blood returns to your heart from your body and lungs.
2. Blood flows from the upper to the lower chambers.
3. Blood is pumped back out to your lungs and body.



If the video does not run, select the movie button.

Heart Basics CS-106-0001

(CirculatorySystem.wmv)

All of the parts of your heart, like the chambers and valves, work together to ensure that blood always flows on the same path on its way through your heart and lungs.

STEP 1. Blood returns to your heart from your body and lungs. Oxygen-poor blood from your body flows into your right atrium. At the same time, oxygen-rich blood from your lungs flows into your left atrium.

STEP 2. Blood flows from the upper to the lower chambers. Blood flows from your right atrium into your right ventricle. At the same time, blood flows from your left atrium into your left ventricle.

STEP 3. Blood is pumped back out to your lungs and body. Your right ventricle pumps blood out of your heart to your lungs, where the blood's oxygen supply is replenished. At the same time, your left ventricle pumps blood — once again full of oxygen — out of your heart to your body.


Blood flows through each chamber one time on its way through your heart — first through the right side of your heart and then through the left.

Heart Basics - Script

Slide 8

What makes blood flow?

- Pressure changes in the heart allow blood to flow.
- Blood pressure:
 - When the heart beats—systolic pressure
 - When the heart is at rest—diastolic pressure
 - Measured in millimeters of mercury (mm Hg)

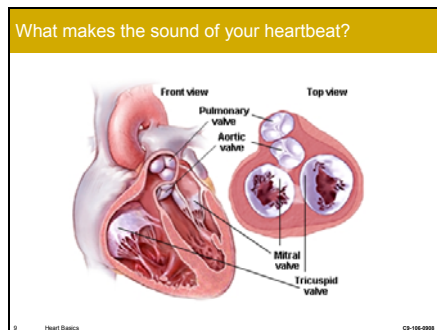


Heart Basics CS-106-0201

Blood doesn't flow by itself — your heart's chambers work hard to keep blood moving. The chambers relax and expand to let blood flow into them. Then they tighten and pull inward (contract) to help push blood out.

You might hear your nurse talk about your *diastolic pressure* or *systolic pressure* when you get your blood pressure checked. When a chamber is relaxed, or expanded, it is in *diastole*. When a chamber is contracted, or small, it is in *systole*.

Slide 9



When you listen to your heartbeat through a stethoscope ("lubb-dubb lubb-dubb"), you hear the sound of your heart valves closing. Although your heart has four valves, the valves open and close two at a time. That's why you hear only two thumps (one "lubb-dubb") per heartbeat, rather than four.

Your heart valves keep blood flowing in one direction through your heart, just like the one-way valves in your home's plumbing. They open to let blood flow through, and then close to prevent blood from flowing back the way it came. When a valve closes, flaps of tissue on the valve close tightly together to create a seal. These flaps of tissue are called *leaflets*.

Atrioventricular valves control blood flow between your heart's upper and lower chambers. The valve between the right atrium and the right ventricle is called the *tricuspid valve*. The valve between the left atrium and the left ventricle is called the *mitral valve*.


Semilunar valves control blood flow out of your heart. Blood flows out of the right ventricle to the lungs through the *pulmonary valve*. Blood flows out of the left ventricle to your body through the *aortic valve*.

Heart Basics - Script

Slide 10

The heart's electrical system

- The natural pacemaker is the SA node
- Signals created by SA node follow path through heart walls
- Movement of electrical signals causes chambers to contract, relax
- Heart's electrical system automatically responds to body's changing need for oxygen



If the video does not run, select the movie button

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10 Heart Basics CS-106-0004

(GDTanim Electrical.wmv)

The S-A node is a bundle of specialized cells in your right atrium; they create the electricity that makes your heart beat. The S-A node normally produces 60-100 electrical signals per minute — this is your heart rate, or pulse.

The A-V node is a bundle of specialized cells between your heart's upper and lower chambers (between the atria and ventricles). The A-V node is the "electrical bridge" between the atria and ventricles.

The His-Purkinje system is in your heart's ventricles. Electricity travels through the His-Purkinje system to make your ventricles contract. It includes the His Bundle (the start of the system), the right bundle branch, the left bundle branch and the Purkinje fibers (the end of the system).


Slide 11

Your heart in action

- Beats about 70 times per minute
- In an average lifetime, beats 2.5 billion times

In one heartbeat ("lub-dubb"):

- chambers contract and relax
- the valves open and close
- blood flows through



If the video does not run, select the movie button

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11 Heart Basics CS-106-0004

(BSC-electrical.avi)

Your heart sound (lub-dub) is the sound of heart valves closing.

The conduction system is influenced by the body's nervous system via electrical signals that travel from the brain to the heart. The nervous system can change the speed of your heartbeat in a matter of seconds. If you are feeling stressed, for example, your heartbeat may speed up. Your heartbeat will also increase when your body needs more blood, such as when you exercise. If you are relaxed, your heartbeat may slow down.

Heart Basics - Script

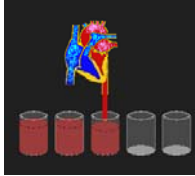
Slide 12

Measuring how well your heart works

- Heart beats 60-100 times every minute for your lifetime.
- Ejection Fraction** is the percent of blood pumped with each beat.
- Cardiac Output** is the volume of blood pumped with each minute.
- Stroke volume** is the volume of blood pumped with each beat.

$CO = \text{Stroke Volume} \times HR$

At rest,
- SV = 0.07L
- HR = 72 bpm
- CO = 5.0 L/min



12 Heart Basics CS-106-0001

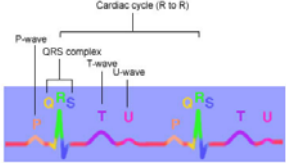
The term "ejection fraction" refers to the percentage of blood that's pumped out of a filled ventricle with each heartbeat. This measures the capacity at which your heart is pumping. A normal heart pumps out a little more than half the heart's volume of blood with each beat. A normal EF is 55 percent or higher.

Your doctor can order simple, painless tests such as an echocardiogram that creates a moving picture of your heart using harmless soundwaves, or a nuclear medicine test that shows how well your heart is pumping. If your EF is abnormally low, you may need further tests to see if you have an abnormal heart rhythm.

Slide 13

Recording electrical activity in your heart

Parts of an electrocardiogram (ECG)



13 Heart Basics CS-106-0001

If your doctor suspects a problem in your heart's electrical system, he or she may schedule you for an electrocardiogram (ECG). An ECG is a recording of the electrical activity in your heart. You've probably seen an ECG on television or when visiting someone in the hospital. The ECG monitor is usually next to the patient's bed. It shows what looks like an electric current on its monitor, and it makes a "blip, blip, blip" sound.

The hills and valleys on an ECG recording are called waves. Each wave tells your doctor a story about how your heart is working (Figure 1):

The *P-wave* shows your heart's upper chambers (atria) contracting.

The *QRS complex* shows your heart's lower chambers (ventricles) contracting.

The *T-wave* shows your heart's lower chambers (ventricles) relaxing.


Heart Basics - Script

Slide 14

A few fun heart facts


Mouse heart

- Beats 500 times/minute
- Weighs less than ½ ounce



Hummingbird heart

- Beats 1,260 times/minute (21 beats per second)
- Weighs 0.003 ounce



14 Heart Basics CS-106-0301

Your heart or mine might beat 72 times per minute, while we breathe 18 times per minute. The next time you hold your pet—cat, dog, mouse, turtle—take note of its pulse and breath. Are they much more rapid than yours?

Slide 15

A few fun heart facts


Elephant heart

- Beats 28 times/minute
- Weighs up to 61 pounds
- Some blood vessels over 10 feet long



Blue whale heart

- Beats 80 times/minute at surface; 35 beats/minute when diving
- Weighs 1,500 pounds; as big as a car
- Pumps 2,500 gallons of blood through body



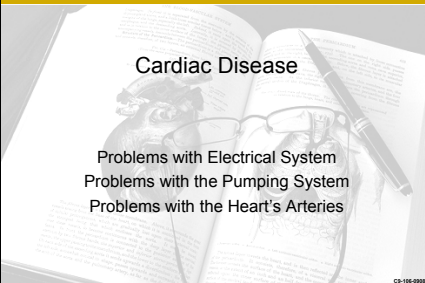
15 Heart Basics CS-106-0301

It turns out that any mammal's heart beats about four times per breath. However, pulse and respiration each decrease roughly as the fourth root of body mass. That means a 25-pound whippet breathes twice as fast as a 400-pound gorilla.

Slide 16

Cardiac Disease

Problems with Electrical System
Problems with the Pumping System
Problems with the Heart's Arteries



CS-106-0301

Cardiovascular disease is a problem in your heart or blood vessels. Many of these problems have similar names, like heart attack and heart failure, or cardiac arrest and sudden cardiac death. It can be hard to keep them all straight. This section will help you sort out the differences among the most common types of cardiovascular disease.


Slide 17

When electrical system "misbehaves"

Bradycardia

- Heart beats too slowly
- Heart may not pump enough blood to meet body's needs
- May feel tired or dizzy

A normal heart rate is from 60 to 100 bpm
Bradycardia heart rate are less than 60 bpm



If the video does not run, select the movie button.

17 Heart Basics CS-106-0301

(Bradycardia.wmv)

In bradycardia, the heart beats more slowly than normal – usually less than 60 beats per minute. As a result, your heart may not pump enough blood to meet your body's needs, and you may feel tired or dizzy.


Heart Basics - Script

Slide 18

When electrical system "misbehaves"

Atrial Fibrillation

- An abnormally fast and chaotic heart rate in the atria
- Electrical signals start irregularly from many areas in the atria
- Disorganized electrical signals cause the atria to quiver rather than beat;
- It can create an irregular heart rhythm in the ventricles



Atrial Fibrillation

If the video does not run, select the movie button

18 Heart Basics © 2008 Boston Scientific-CRM

With atrial fibrillation, the heart's upper chambers (the atria) quiver between 300 and 600 times per minute. The atria never fully contract, so some blood may stay in the atria with each heartbeat. The pooled blood could clot, increasing your risk of stroke.

Affects about 2.3 million people in the United States and about 6 million worldwide.

Prevalence increases with age, from 0.5 percent among young adults to more than 6 percent among those 80 years of age or older, and is expected to grow by at least 200% over the next 35-45 years.

Incidence of atrial fibrillation approximately doubles with each decade of adult life.


(Fuster V, Ryden LE, Asinger RW, et al. *J Am Coll Cardiol.* 2001;38:1266ii-ixx.)

Slide 19

When electrical system "misbehaves"

Ventricular Tachycardia

- The heart beats more quickly than normal
- Can be normal, i.e., with exercise
- Heart may not pump enough blood to meet body's needs
- Left untreated, some types can lead to sudden cardiac death (SCD)



Ventricular Tachycardia

If the video does not run, select the movie button

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(GDTanim Tachy.wmv)

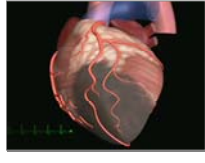
With ventricular tachycardia, the heart beats more quickly than normal – usually more than 100 beats per minute. As a result, your heart may not pump enough blood to meet your body's needs. If left untreated, some types of tachycardia can lead to sudden cardiac death (SCD).

Slide 20

When electrical system "misbehaves"

Ventricular Fibrillation

- Electrical signals move chaotically through heart, preventing proper blood flow
- Lack of blood circulation causes most people to faint
- Only way to end VF is electrical shock
- Cardiopulmonary resuscitation (CPR) can maintain oxygenated blood flow to brain and vital organs, but cannot convert heart to normal rhythm
- Untreated, VF will lead to SCD



Ventricular Fibrillation

If the video does not run, select the movie button

20 Heart Basics © 2008 Boston Scientific-CRM

(SCD.wmv)

Ventricular fibrillation is a very fast and chaotic heart rate in the ventricles. It causes the heart to beat more than 200-300 times a minute. Disorganized electrical signals cause ventricles to quiver, rather than beat. As a result, there is no circulation of blood.

The most dangerous type of abnormal heart rate, VF can lead to sudden cardiac arrest, and possible death.

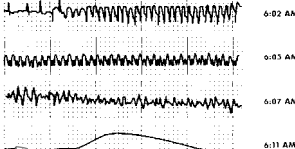
Heart Basics - Script

Slide 21

When electrical system "misbehaves"

Sudden cardiac death or cardiac arrest

- Sudden and unexpected
- A medical emergency that will end in death if not treated quickly



6:02 AM
6:03 AM
6:07 AM
6:11 AM

Total: 9 minutes
This patient was playing a morning round of golf while wearing a Holter monitor when he experiences sudden cardiac death.

21 Heart Basics CS-106-0301

Sudden cardiac arrest (SCA) is when the heart abruptly and unexpectedly ceases to function. Rhythms such as ventricular fibrillation can lead to SCA.

Within seconds after VF begins, a person can faint and lose consciousness.

If not treated within a few minutes with a defibrillator, SCA can lead to sudden cardiac death.

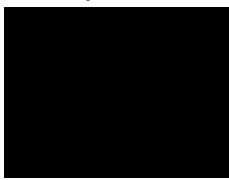
SCD is the leading cause of death in the US. More people die of SCD than from AIDS, breast cancer, and lung cancer combined.)

Slide 22

Problems with the heart's pumping ability

Heart Failure

- Heart cannot pump well
- Heart muscle damaged by disease or injury
- Cannot pump enough blood and oxygen to meet body's needs
- Develops over time in damaged heart



If the video does not run, select the movie button.

22 Heart Basics CS-106-0301

(HF1.asf)

Heart failure does not mean that the heart suddenly stops working; it happens slowly as your heart muscle gradually weakens. Usually, it begins when the heart is injured or damaged.

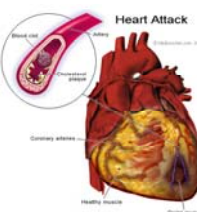
"Failure" means the heart is not able to pump enough blood and oxygen to meet your body's demands. Important organs like your brain and kidneys cannot function properly without enough blood.

Slide 23

Problems with the heart's arteries

Coronary Artery Disease

- When a coronary artery is occluded oxygenated blood can't reach cells downstream causing:
 - **Ischemia** – low oxygen state leading to tissue hypoxia
 - **Infarction** – Area of tissue death due to lack of oxygen
 - **Arrhythmias**



Healthy Arteries
Coronary Arteries
Heart Attack

23 Heart Basics CS-106-0301

With coronary artery disease, fatty plaque builds up in one or more coronary arteries, so less blood flows through to the heart muscle. CAD increases your risk for a heart attack.

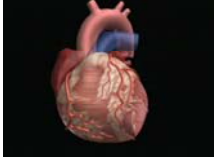
Heart Basics - Script

Slide 24

Problems with the heart's arteries

Heart Attack (myocardial infarction)

- Plaque buildup in the arteries ruptures and forms a blood clot or completely blocks blood flow
- Lack of oxygen causes cells to die and scar
- Some survivors are at increase risk of SCA



If the video does not run, select the movie button

24 Heart Basics CS-100-0901

(heartattack.wmv)

When a part of the heart muscle dies or is permanently damaged, you're at higher risk for heart failure and sudden cardiac death (SCD).

Slide 25

Additional resources for patients and families

Online resources:

American Heart Association: www.americanheart.org
CardioSmart: www.cardiosmart.org
Heart Rhythm Society: www.hrspatients.org
Sudden Cardiac Arrest Association: www.suddencardiaccarrest.org
WomenHeart: www.womenheart.org

25 Heart Basics CS-100-0901

General resources.

Slide 26

Resources from Boston Scientific

LifeBeat patient newsletter

- Current and past issues at www.lifebeatonline.com
- Every issue includes articles about:
 - The road to recovery after implant
 - Cardiac news
 - Interviews with patients
 - You asked. We Answered.

Heart health information

www.lifebeatonline.com



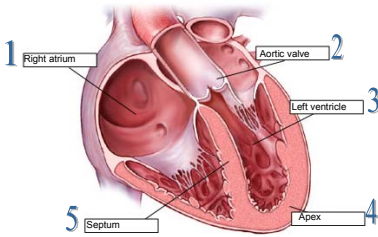
26 Heart Basics CS-100-0901

Boston Scientific resources.

Slide 27

Quiz Time

Label parts of your heart



27 Heart Basics CS-100-0901

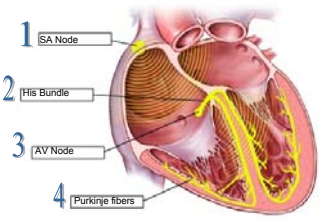
Click to see each answer in numeric order

Heart Basics - Script

Slide 28

Quiz Time

Label your heart's electrical system



1 SA Node
2 His Bundle
3 AV Node
4 Purkinje fibers

28 Heart Basics CS-100-0908

Click to see each answer in numeric order

Slide 29

Quiz Time

- What is bradycardia?
 - A problem with the heart's electrical system
 - A problem with the heart's blood vessels
- What is it called when the heart completely stops beating and pumping blood?
 - Sudden cardiac death
 - Heart attack
 - Heart failure
- Which statement is true of heart failure?
 - It occurs suddenly and without warning
 - It occurs slowly, sometime over a period of years
- What is a heart attack?
 - A problem with the heart's pumping ability
 - A result of clogged coronary arteries

29 Heart Basics CS-100-0908

Click to see each answer starting on the left

Bradycardia is a slower than normal heart beat, and it's your heart's electrical system that controls the speed of your heartbeat.

SCD is when your heart completely stops beating and pumping blood. Though the terms are often confused, sudden cardiac death is not a heart attack.

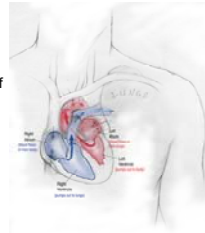
Heart failure develops gradually over time, usually because of other problems in your heart. It isn't something that appears overnight or occurs suddenly.

A heart attack is an event that results in permanent damage to your heart because your heart didn't get enough blood. Why? Because a clogged artery wouldn't let the blood flow through.

Slide 30

The Heart: In summary

- Delivers 5 L/min blood to the rest of the body
 - Beats 7200 L/day
 - 1500 circulations/day
- Will continue to beat outside of the body
- Requires a lot of energy
- Take care of it - it will take care of you!

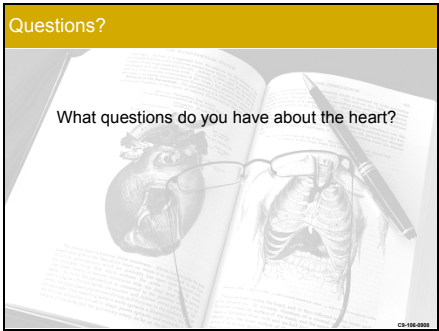


30 Heart Basics CS-100-0908

Bottom line, take care of your heart and it will take care of you.

Heart Basics - Script

Slide 31



Slide 32

