

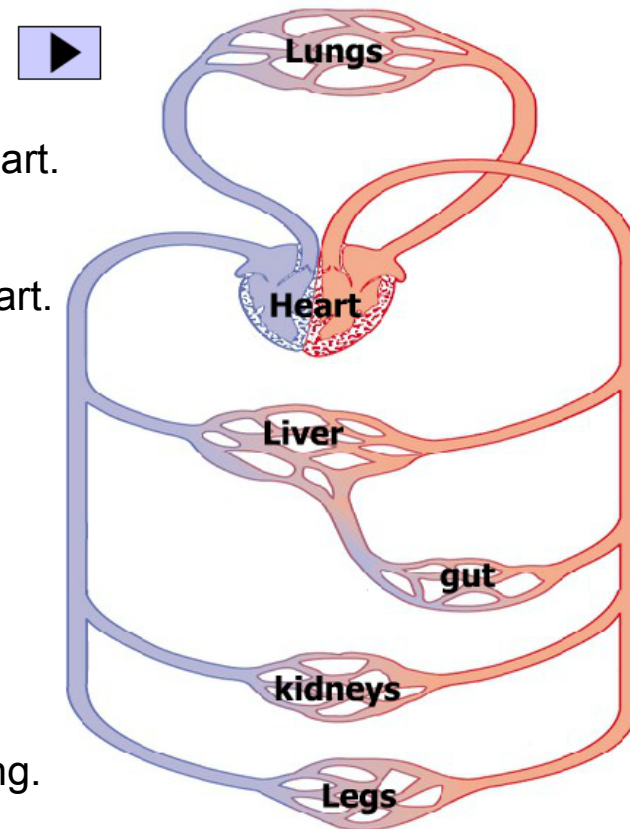
## Chapter 27 - The Heart and Blood Vessels

Most animals have a **closed** blood system.  
The blood flows continuously in vessels back to the heart.

In an **open** system the blood is pumped into open-ended tubes and eventually flows back to the heart.  
e.g. in lobsters and insects.

**A closed system is better because,**

1. The blood can be pumped around the body faster.  
This means the animal can move faster.
2. Different areas can get more blood when needed.  
e.g. More blood can be sent to the legs when running.



# Blood Vessels

**Arteries** - carry blood **Away** from the heart. These have a protein called collagen to stop them bursting. They also have thick muscle as the blood is pumped at high pressure. They have a narrow lumen (hole) to keep the blood under pressure.

Small arteries are called **arterioles**.

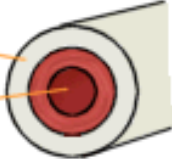
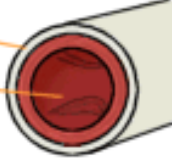

**Veins** - carry blood **to** the heart. These have less muscle and need valves to stop the blood from flowing backwards (**backflow**). The blood moves slowly in the veins.

Muscles in the body help to pump blood in the veins back to the heart.

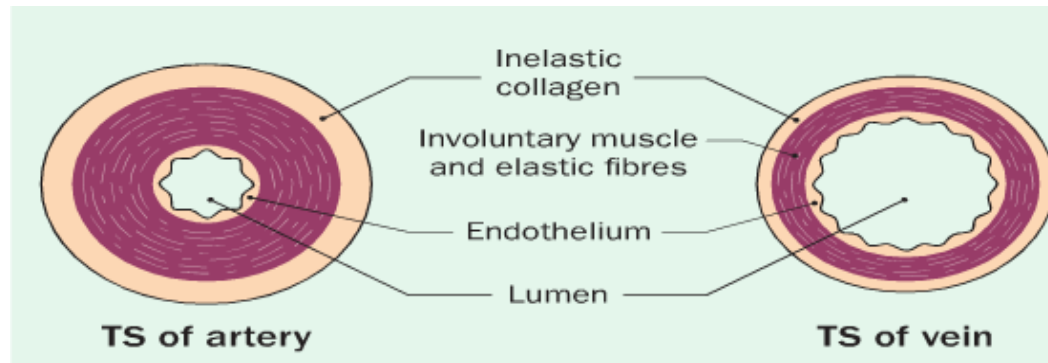
Small veins are called **venules**.

**Capillaries** are tiny (1 cell thick) tubes that **connect** the arterioles and venules to each other.

They are found around the intestines, lungs, liver and other organs.

Artery	thick, elastic wall small lumen 
Vein	thin wall large lumen valve 
Capillary	single cell wall 

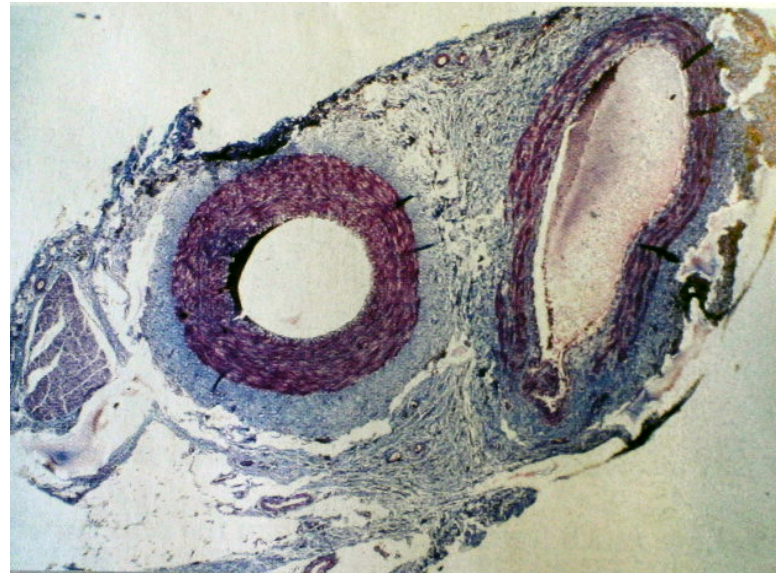
## Artery and Vein Comparison



**Collagen** stops the vessel from bursting.

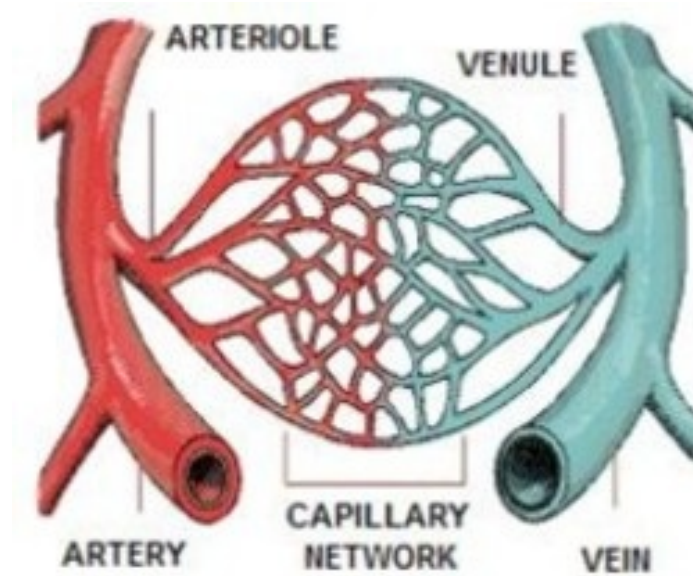
**Muscle** can expand and contract.

**Endothelium** lines the lumen.



# Blood Vessels

Artery → Arterioles → Capillary → Venule → Vein



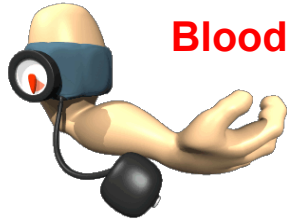
# Blood Flow

The muscles and elastic fibres in the middle layer of arteries and veins can **change size**. This means it can let more blood through when we **exercise**, when we get too **hot** or when we are **embarrassed**.



Increased blood flow near the skin means that we lose more heat and so cool down more quickly. The elastic fibres bring the vessels back into shape after we have cooled down.

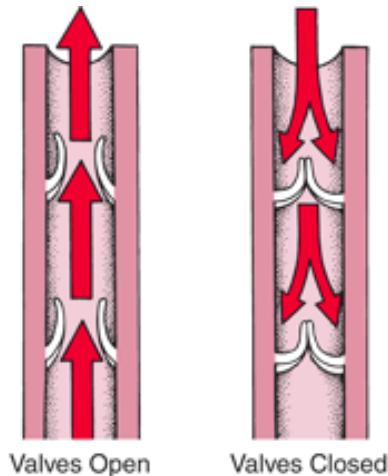
## Blood Pressure and Valves



**Blood Pressure is the force the blood exerts against the wall of a blood vessel.**

**Where do you think the highest blood pressure would be?**

The blood pressure in the arteries is the highest and causes them to expand (**your pulse**).  
The blood pressure in the veins is the lowest.  
Physical activity helps to push blood back to the heart.



**Valves control the direction of blood flow in veins.**

**Valves** stop the blood flowing backwards (backflow). If the blood does start to flow backwards it shuts the valves.



## Main Arteries and Veins in the Body



## Summary of Arteries and Veins

Summary of arteries and veins	
Artery	Vein
Carries blood away from the heart	Carries blood to the heart
Blood under high pressure	Blood under low pressure
Thick walls	Thin walls
Small lumen	Large lumen
Blood flows in pulses	Blood flows smoothly (no pulses)
Valves absent	Valves present
Blood rich in oxygen (except pulmonary artery)	Blood low in oxygen (except pulmonary vein)



# The Heart

The Heart is made of cardiac muscle that never tires.  
It's surrounded by a liquid filled membrane called the **pericardium**.

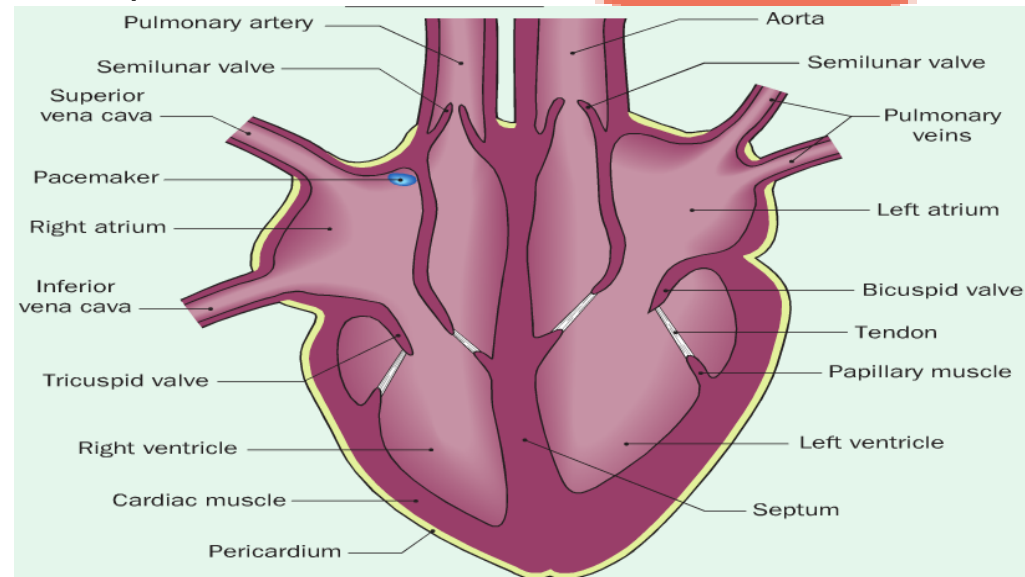
## Structure

The heart is divided into 2 sides by the septum.  
There are 4 chambers in the heart.

The **Atria** (Left and Right Atrium)  
are above the **Ventricles**.  
Remember **Alps over Valleys**.

**Draw the Heart!**

**Pacemaker Video**



## Blood Flow in the Heart

**You have to remember that left is right and right is left!**

**Deoxygenated** blood enters the heart through the **Vena Cavae** - inferior and superior. This blood is now in the **Right Atrium**. The chamber contracts and pushes the blood down through the **Tricuspid Valve**. The vena cavae close to stop backflow.

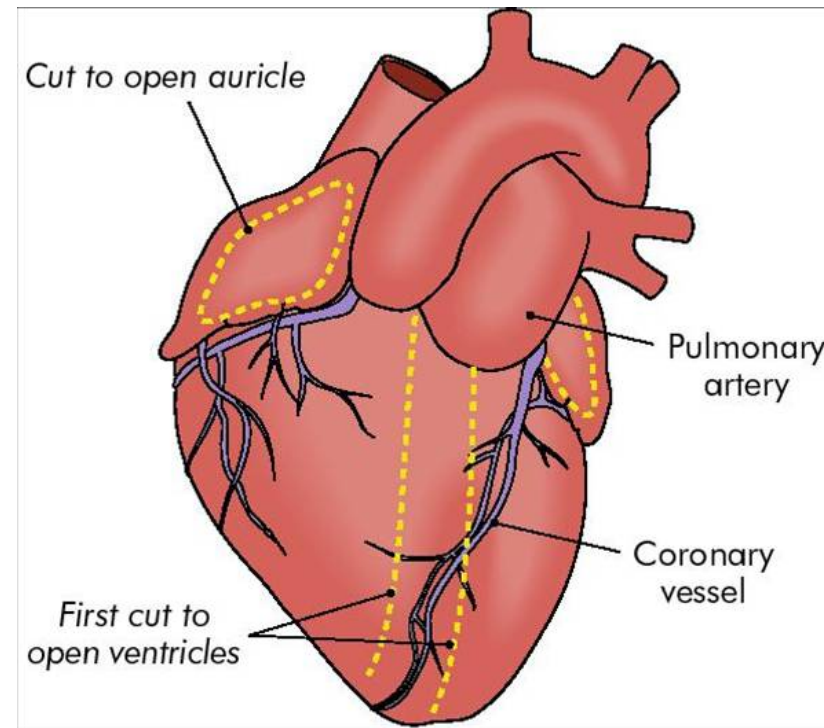
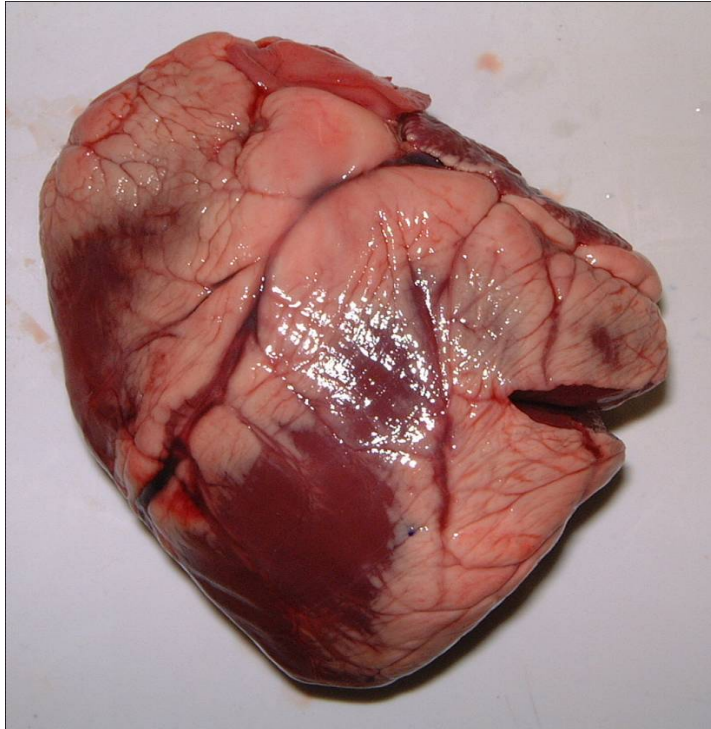
The blood enters the **Right Ventricle** and when it contracts the tricuspid valve is closed and blood is pushed out through the **Semilunar Valve** into the **Pulmonary Artery**. This carries the blood to the **Lungs**.

The blood picks up **Oxygen** in the lungs and is carried back to the heart in the **Pulmonary Vein**. This enters the heart in the **Left Atrium**, which then contracts, closing the pulmonary vein and opening the **Bicuspid Valve**.

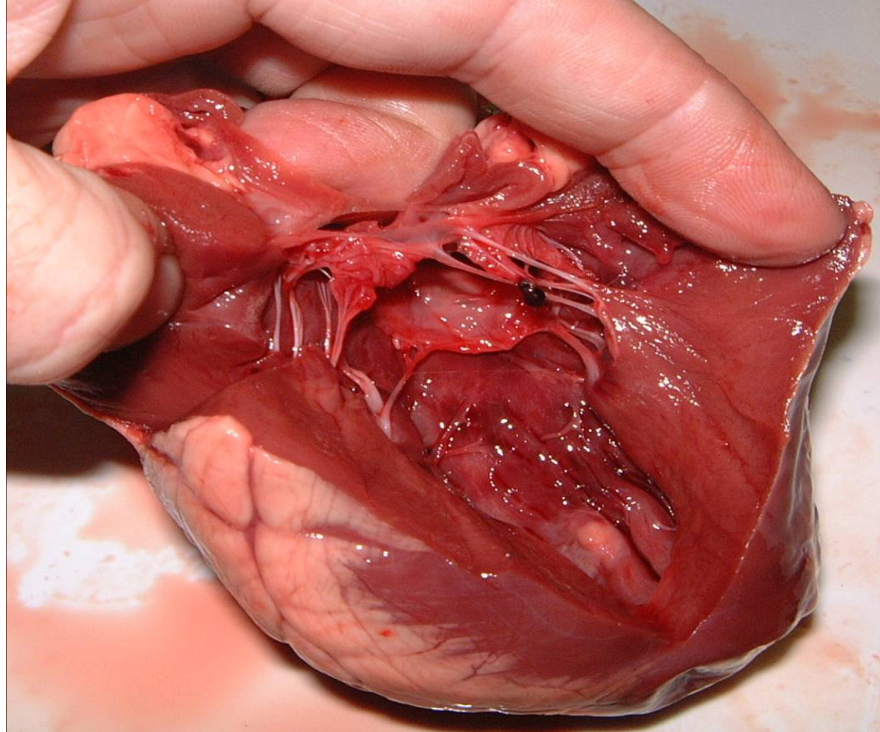
The blood enters the **Left Ventricle** and when it contracts the bicuspid valve is closed and blood is pushed out through the **Semilunar Valve** into the **Aorta** (artery). This carries the blood to the **Body**.



# Heart Dissection



## Compare the left and right muscle walls



## Double Circulation

The heart acts as a double pump.

One side pumps to the lungs (**Pulmonary circuit**)

The other side pumps to the whole body (**Systemic circuit**)

The double circulation system allows **oxygen-rich** blood to be kept separate from **oxygen-poor** blood.

### Portal System

A portal system does not connect directly to the heart. The **hepatic portal vein** connects the stomach and intestines to the liver.

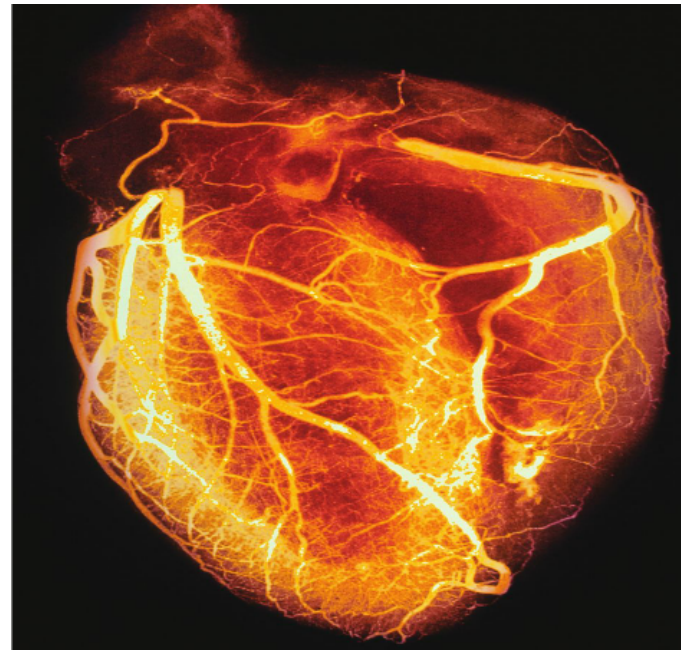


## Blood supply to the Heart

The heart itself needs blood to work.

The **coronary artery** surround the heart and provide it with oxygen.

Blockage of this artery is a common cause of heart attacks.



## Control of the Heart Beat

The heart beat will beat even if not connected to the body.

The heart beat is controlled by a bundle of nerves called the **Pacemaker**.

This sends out an electric pulse that causes the muscle to contract and so blood is pumped around the heart.

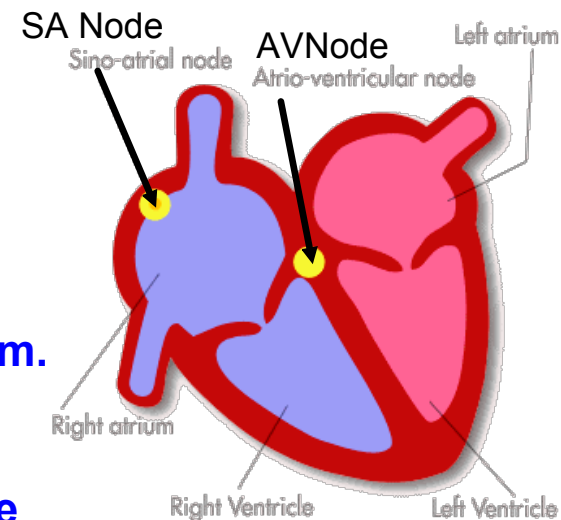
### Steps

The SA (sino-atrial) node emits an electrical signal which contracts the atria.

The signal stimulates the AV (atrio-ventricular) node. This sends out its own signal to the septum.

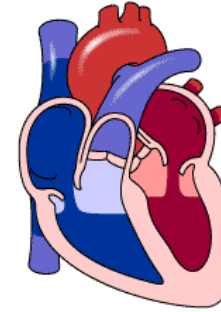
This causes the ventricles to contract.

The pacemaker controls the heartbeat but can be altered by the brain and hormones.



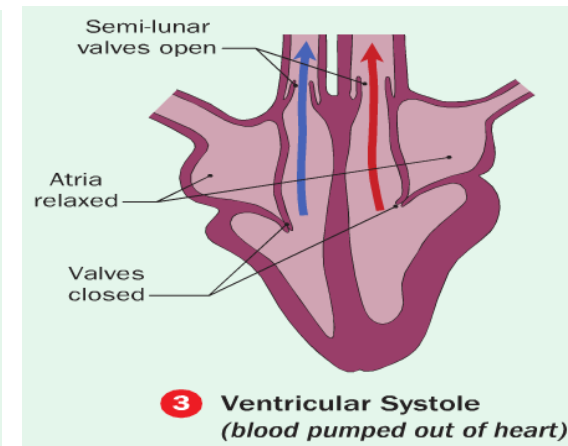
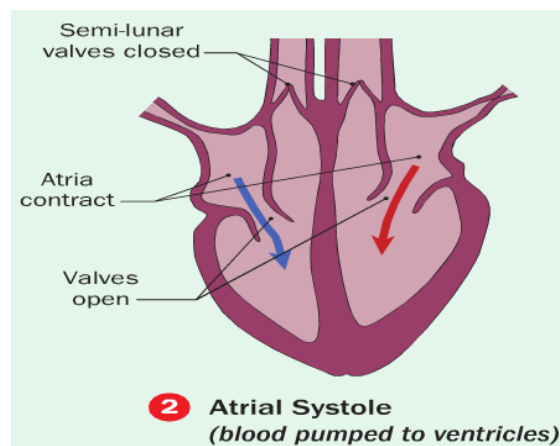
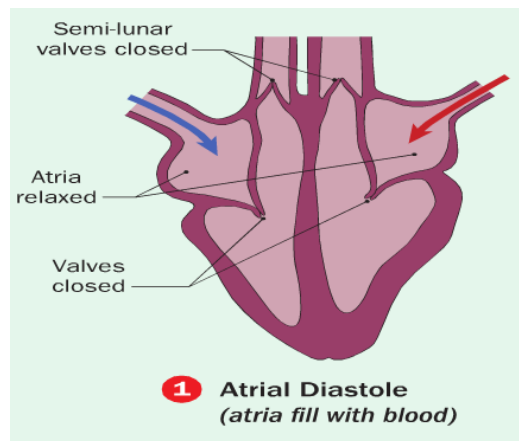


**Diastole** is when the heart chambers relax.  
**Systole** is when the chambers contract.



**The order of steps in a heartbeat is,**

1. Atrial Diastole
2. Atrial Systole
3. Ventricular Systole



**The pulse is the alternate expansion and contraction of the arteries.**

# Blood Pressure

The blood pressure is measured using a **sphygmomanometer**. This is placed on an artery in the arm and air is pumped in. The pressure needed to stop the blood flow is measured (this is why it hurts a bit!).

The pressure is given in two values, one over the other.

1. The ventricles are contracted (**systolic pressure**) as the blood goes past.
2. The ventricles are relaxed (**diastolic pressure**) when there is no pulse.

A typical blood pressure is **120/80** mm of mercury. These values rise with age normally.



# Experiment

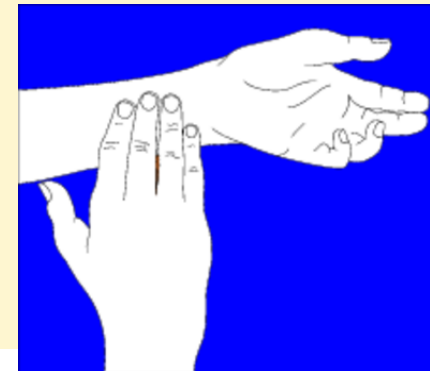
**Activity 19a**

To investigate the effect of exercise on the pulse rate of a human

You have a choice between this activity and investigating the effect of exercise on the breathing rate of a human (Activity 19b on page 309).

- 1 Work in pairs, one person recording the results.
- 2 Locate a strong pulse in your neck or wrist (just below the thumb).
- 3 Count the number of pulses per minute while at rest.
- 4 Repeat this four times and calculate your average pulse rate per minute at rest. Record your results. (This value is used as a control.)
- 5 Walk slowly for 5 minutes.
- 6 Count your pulse rate per minute immediately after walking. Repeat this until your pulse rate returns to (or below) normal.
- 7 Exercise strenuously for 2 minutes (e.g. step up and down on a chair every 3 seconds).
- 8 Count your pulse rate per minute immediately after exercising.

- 9 Repeat this every minute for 6 minutes or until the pulse returns to the resting rate.
- 10 Compare your resting rate with the rate immediately after exercise. Calculate how long it took you to return to a normal pulse rate.
- 11 Present your aims, methods, results and conclusions in a written report.



## Smoking and Diet

### Smoking -

**Nicotine** is more addictive than heroin. It increases the heart beat and raises blood pressure. This strains the heart.

**Carbon Monoxide** joins to haemoglobin instead of Oxygen and lowers the energy production as ATP is not made. Other chemicals increase the likelihood of clots and lung cancer.

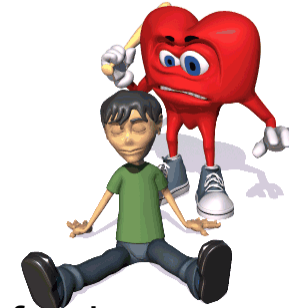


### Diet -

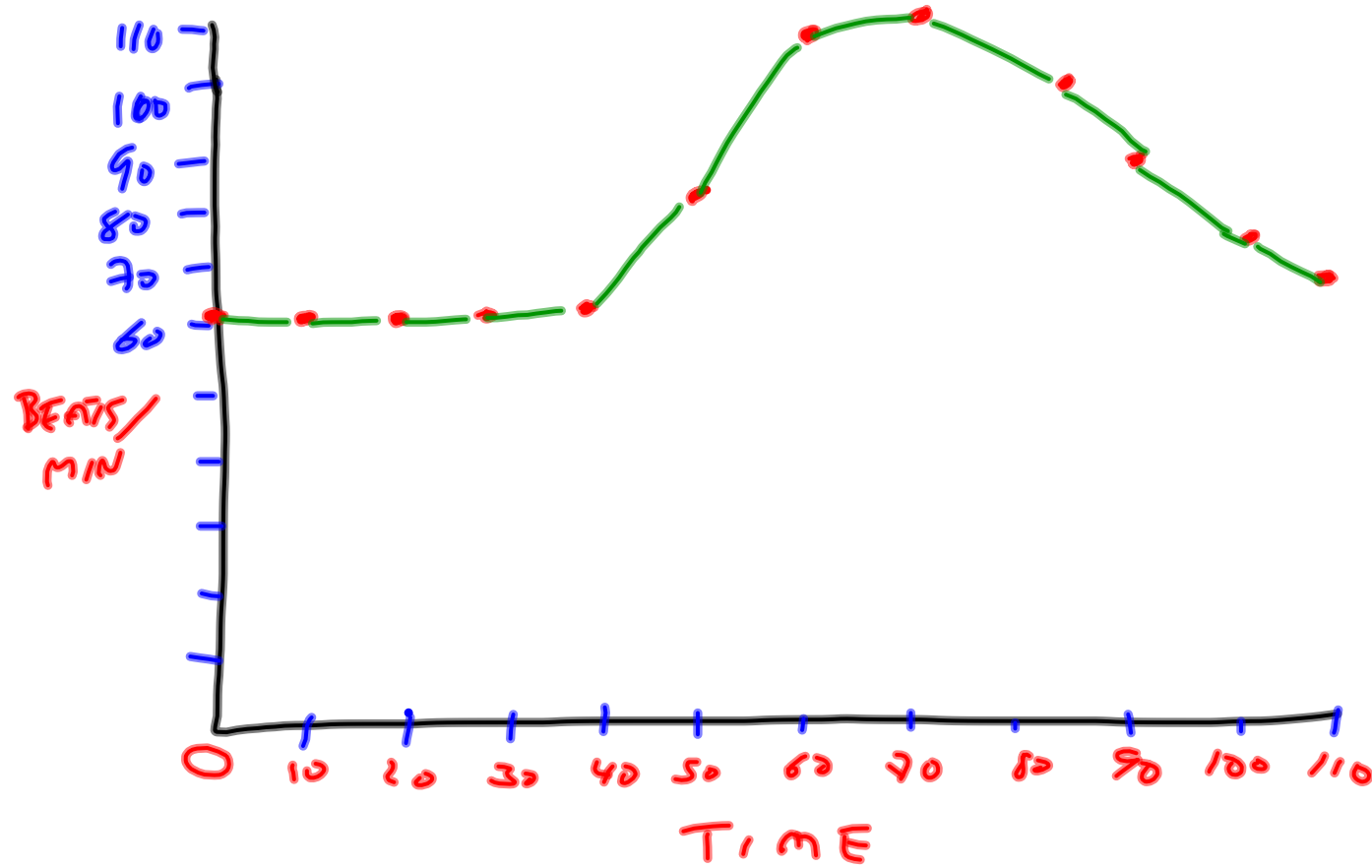
**Fat** intake, **salt** levels and body **weight**.

Saturated fats block vessels and cause cholesterol to build up. Coronary arteries and the brain are affected causing heart attacks and strokes.

Salt increases blood pressure, processed foods have more than fresh.



**Obesity** - is 20% over weight and is a growing problem.





**Blow in her face and she'll follow you anywhere.**

Hit her with tangy Tipalet Cherry. Or rich, grape-y Tipalet Burgundy. Or luscious Tipalet Blueberry. It's Wild! Tipalet. It's new. Different. Delicious in taste and in aroma. A puff in her direction and she'll follow you, anywhere. Oh yes... you get smoking satisfaction without inhaling smoke.

			
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Smokers of America, do yourself a flavor. Make your next cigarette a **Tipalet.**

New from Muriet. About 5 for 25¢.

"Believe me, folks, you'll want to read this important new evidence on the effects of smoking. Then you'll say, as I do... **MUCH MILDER**  
**CHESTERFIELD IS BEST FOR ME!"**  
*William Goldfrey*

**NOW... Scientific Evidence on Effects of Smoking!**

A MEDICAL SPECIALIST is making regular bi-monthly examinations of a group of people from various walks of life. 45 percent of this group have smoked Chesterfield for an average of over ten years.

After ten months, the medical specialist reports that he observed...

no adverse effects on the nose, throat and sinuses of the group from smoking Chesterfield.

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*According to repeated nationwide surveys,*

# More Doctors Smoke **CAMELS** than any other cigarette!



**Doctors in every branch of medicine were asked, "What cigarette do you smoke?" The brand named most was Camel!**

You'll enjoy Camels for the same reasons so many doctors enjoy them. Camels have cool, cool mildness, pack after pack, and a flavor unmatched by any other cigarette. Make this sensible test: Smoke only Camels for 30 days and see how well Camels please your taste, how well they suit your throat as your steady smoke. You'll see how enjoyable a cigarette can be!

**THE DOCTORS' CHOICE IS AMERICA'S CHOICE!**





**MARJORIE W. BARK** says: "I pick Camels. They don't hurt my throat and taste wonderful."



**DR. DAVID L. BROWN** says: "I get more pleasure from Camels than from any other brand."



**DR. WALTER HILLARY** says: "Camels are my taste and throat. I've smoked 'em for years."



*For 30 days, test Camels in your "T-Zone" (T for Throat, T for Taste).*





## Aerobic Exercise

Regular exercise strengthens the heart and lungs. The **heart** grows **bigger** and works more efficiently. **Blood circulation** is improved because the blood is pumped around the body better. Body weight and **fat** levels are **reduced** helping the heart to work more easily.





# Heart Surgery

