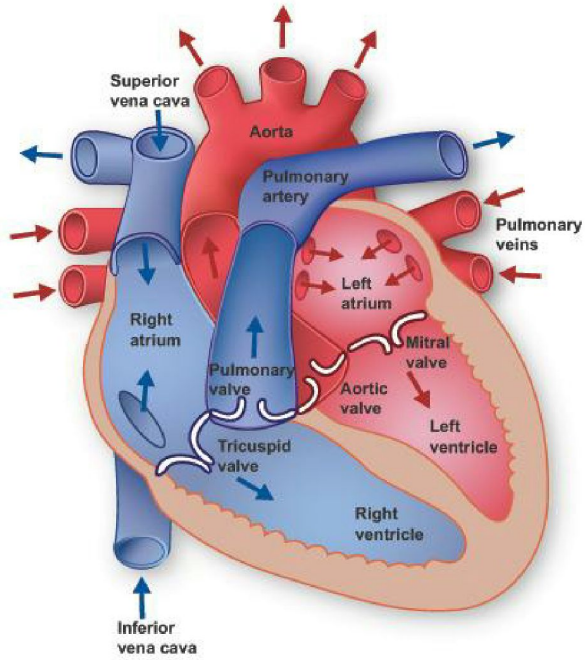
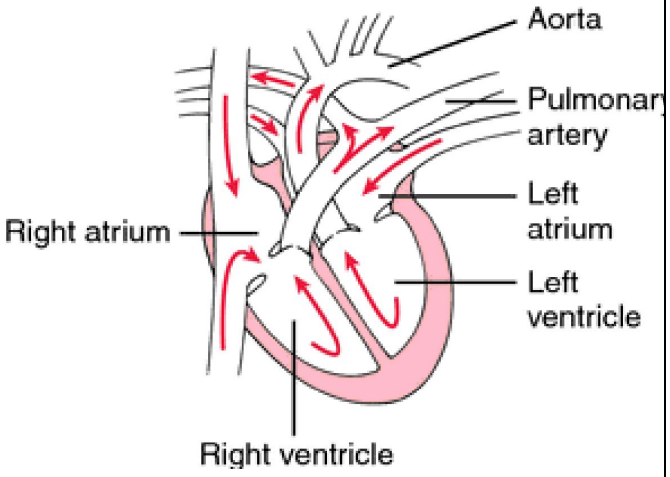
Unit 4 Study Guide

4.1 – Heart Structure

- **EQs 1 & 4 & 5 – What are the structures that make up the human heart and how are they organized? What are the functions of valves in the heart? How does the structure of arteries and veins relate to their functions?**

Category	Characteristics	Includes
chambers	open, like rooms—hold blood	right and left **atria** and right and left **ventricles**
valves	flaps, like doors—let blood move one way; create a 1-way flow of blood through the heart	**tricuspid**, **bicuspid (mitral)**, **aortic** & **pulmonary**
veins	bring blood to heart—tubes, like halls; thin walls (no muscle layer); very little contraction	**superior & inferior vena cavae** & **pulmonary veins**
arteries	carry blood from heart—tubes, like halls ; thick walls (thick muscle layer); capable of contraction – creates pulse	**pulmonary arteries**, **aorta**





- **EQs 2 & 3 – How do the heart and lungs work together to pick up and deliver oxygen to the cells? What is the pathway blood takes as it passes through the heart?**

- Pulmonary arteries carry deoxygenated blood into the lungs and pulmonary veins carry the oxygenated blood back to the heart to be sent to the body. A capillary network in all of the body's tissues allows for the exchange of gases (O_2 and CO_2).
- right atrium → tricuspid valve → right ventricle → PSV → pulmonary arteries → lungs for oxygen → pulmonary veins → left atrium → bicuspid (mitral) valve → left ventricle → ASV → aorta → arteries all over body → arterioles → capillaries (to drop off oxygen, nutrient & hormones & pick up waste & CO^2) → venules → veins → vena cavae → right atrium

4.2 – The Heart at Work

- **EQ 1 – In what ways can technology be used to collect and analyze cardiovascular data?**

Thing measured	Tool used	Used how
Blood pressure	Sphygmomanometer *"pulse measurer"*	Determines systolic and diastolic arterial pressure
Heart rate	Timer	Used to find beats during 10 seconds (then multiply by 6 for bpm)
Electricity within heart	EKG	Electrodes on skin pick up current and show graphically

- **EQs 2 & 3– Why is it important to monitor the rate at which the heart beats? What factors can influence heart rate?**

Lower heart rate	Raise heart rate
<u>Short-term method</u> ● Sleeping or relaxing ● Hydrating yourself <u>Long term method</u> ● Exercise ● Reducing stress ● Eating fruits, vegetables, nuts, beans & fish	<u>Short-term method</u> ● Exercising or other rapid movements ● Being scared or very stressed briefly ● Drinking caffeine or alcohol <u>Long term method</u> ● Being out of shape ● Increasing stress
Heart rate can indicate problems with heart function: rapid heart rate (tachycardia), irregular heart rate (a-fib or valve issues).	

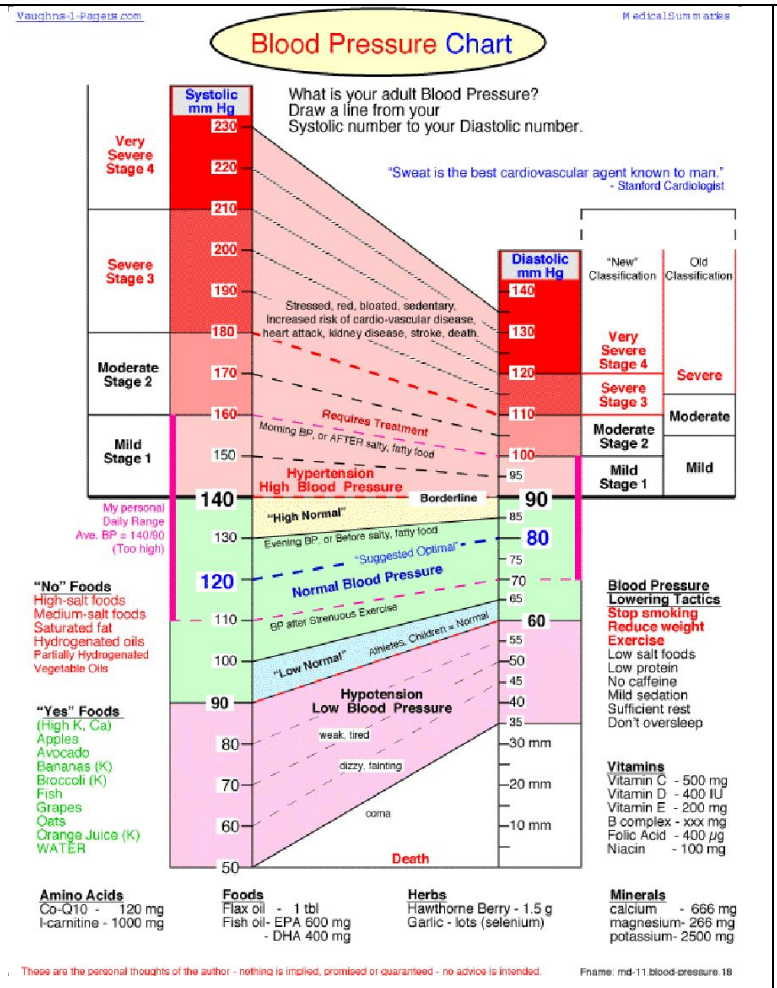
- **EQs 4 & 5 – What is blood pressure? How do systolic and diastolic pressure values relate to the movement of blood in arteries?**

A normal **blood pressure** reading usually indicates a healthy heart, with higher readings indicating that the heart is stressed. It measures the **pressure** on vessel walls from the movement of blood particles.

- Top number **Systolic** pressure in arteries as the ventricles contract & the chambers emptying (always higher)
- Bottom number **Diastolic** pressure in arteries when ventricles are relaxed & the chambers are filling with blood (always lower)

Blood Pressure Category	Systolic mm Hg (upper #)		Diastolic mm Hg (lower #)
Normal	less than **120**	and	less than **80**
Prehypertension	**120 – 139**	or	**80 – 89**
High Blood Pressure (Hypertension) **Stage 1**	**140 – 159**	or	**90 – 99**
High Blood Pressure (Hypertension) **Stage 2**	**160** or higher	or	**100** or higher
Hypertensive Crisis (Emergency care needed)	Higher than **180**	or	Higher than **110**

- **EQ 6 – What factors can influence blood pressure?**

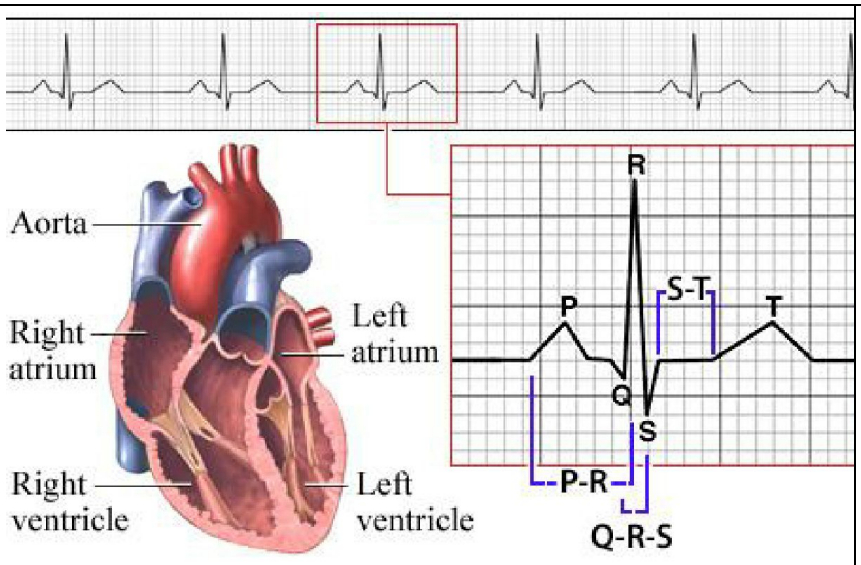


According to the Mayo Clinic, the top 10 ways to reduce your blood pressure or prevent hypertension *("extra tension")* **are to**:

1. Lose extra pounds and watch your waistline
2. Exercise regularly
3. Eat a healthy diet
4. Reduce sodium in your diet
5. Limit the amount of alcohol you drink
6. Avoid tobacco products and secondhand smoke
7. Cut back on caffeine
8. Reduce your stress
9. Monitor your blood pressure at home and make regular doctor's appointments
10. Get support from family and friends

http://www.mayoclinic.com/health/high-blood-pressure/HI00027

- **EQs 7 & 8 – What is an EKG? How can an EKG be used in the diagnosis and treatment of heart disease?**



EKGs, or **electrocardiographs** *("electricity heart pictures")* measure the heart's electrical activity and display it in the form of a picture:

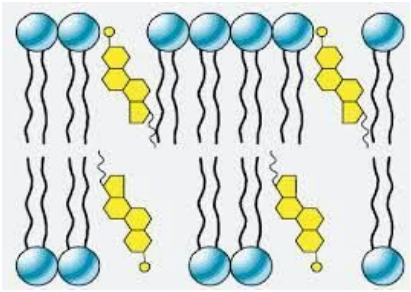
- **P wave** - signal passes from **SA node** (sinoatrial node) to AV node (atrioventricular node), moving across atria
- **QRS interval** - signal passes from AV node through Purkinje fibers & the ventricles contract
- **T wave** - the ventricles repolarize & the heart is relaxed

EKGs are examined for missing, extra or malformed waves.

EKGs are taken when heart problems are suspected and can be used in **cardiology** *("the study of the heart")* to diagnose heart attacks, lack of blood flow to the heart, arrhythmia *("no rhythm")*, lack of forcefulness of heart muscle, muscle parts that are too thick or heart parts that are too big, birth defects of the heart, heart valve diseases.	

4.3 – Heart Dysfunction

- **EQs 1& 2 - What is cholesterol? What roles does cholesterol play in our cells and in the body?**



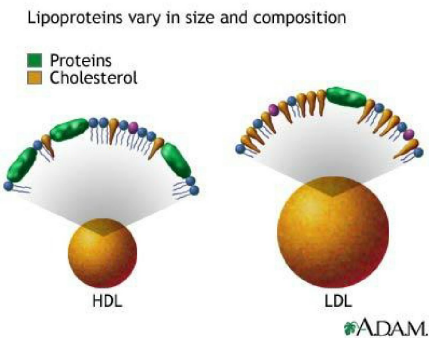
- **EQ 3 – What are HDL and LDL?**

LDL
Low Density Lipoprotein

- Carry **cholesterol** through blood to all tissues—if there's too much it just stays in the blood
- Raises risk of heart disease
- Leads to blood vessel blockages—white blood cells try to digest LDL & convert it to a toxic form. White blood cells create inflammation & that draws more cells & plaque

Both

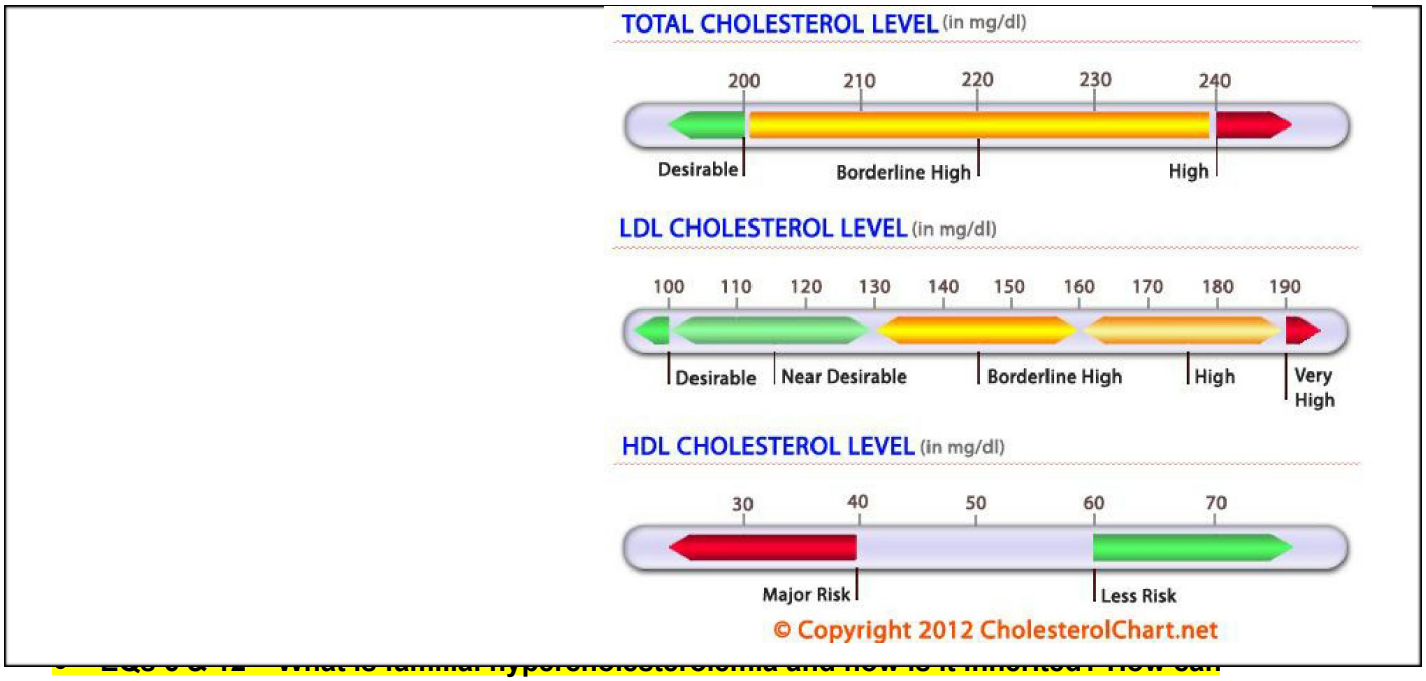
- Part lipid, part protein
- Carry **cholesterol**



HDL
High Density Lipoprotein

- Pick up **cholesterol** in the bloodstream and take it to the liver for removal from the body
- Lowers risk of heart disease
- Reduces blood vessel blockages

- **EQs 4 & 5– How are LDL, HDL, and cholesterol related to heart disease? How do doctors interpret the results of a cholesterol test?**



- **EQs 3 & 12 – What is familial hypercholesterolemia and how is it inherited? How can**

cholesterol plaques affect the overall function of the heart?

of

Familial Hypercholesterolemia *("high cholesterol in the blood* ||) is a dominant autosomal genetic disorder, the result a **mutation** in DNA that is passed from parents to their offspring. The disease typically occurs when a person inherits a dominant **allele** from one parent, giving him a heterozygous *("full of different things joined together")* genotype (Hh). On very RARE occasions, the person has TWO affected parents and inherits the mutation from BOTH

of them, giving him a **homozygous** *("full of same things joined together")* dominant genotype (HH). Either will result in **familial hypercholesterolemia**, but a homozygous dominant genotype makes the condition far worse.
The **phenotype** *("showing type")* of a person with familial hypercholesterolemia is that LDL cholesterol (generally called —bad cholesterol builds up in the bloodstream, leading to very high cholesterol levels in the blood and putting the person at high risk for a heart attack.

Cholesterol plaques narrow the opening in arteries making blood flow more difficult. The result is a harder working heart and higher blood pressure.

- **EQ 7 – How can techniques of molecular biology be used to analyze DNA for the presence of the FH mutation?**

- **EQs 8 & 9 - What lifestyle changes may help a patient obtain healthy cholesterol levels? What are the pros and cons of using cholesterol lowering medicines?**

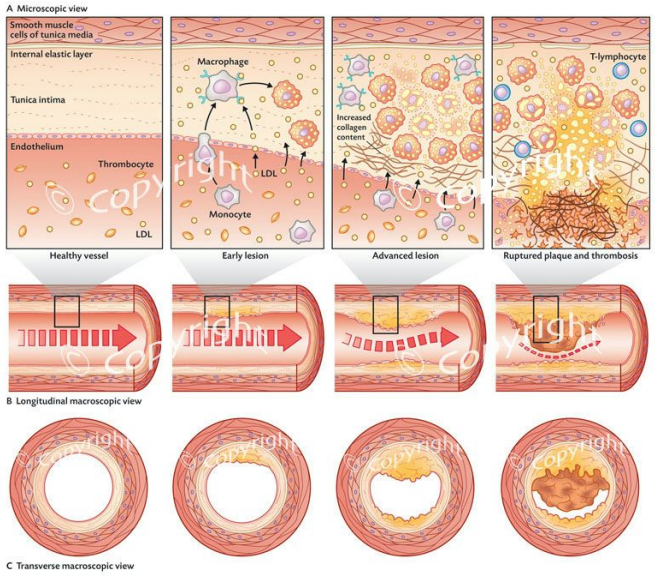
  - Limit Trans and Saturated Fat as they increase LDL
  - Eat unsaturated fats to increase HDL
  - Exercise daily
  - Maintain healthy weight
  - Manage stress and do not smoke
  - Take medications, like statins if needed

- Common cholesterol medication, statins, will decrease LDL, triglycerides, and even CRP (involved in strokes), while slightly elevating HDL
- However it can lead to side effects, such as muscle weakness and pain, even in the heart (since it is a muscle)
- They can also cause amnesia for minutes to hours, headaches, dizziness, and liver dysfunction

- **EQ 10 – How does the heart work like a pump?**

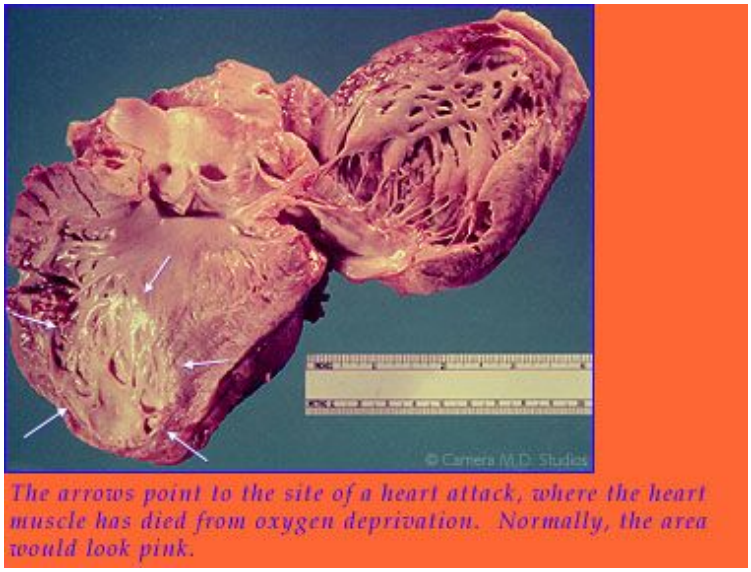
Pumps move fluids using pressure	The heart is a pump because it moves a fluid (blood) using pressure (contractions of ventricles). The heart powers the whole **cardiovascular system**.

- **EQ 11 – What is atherosclerosis?**



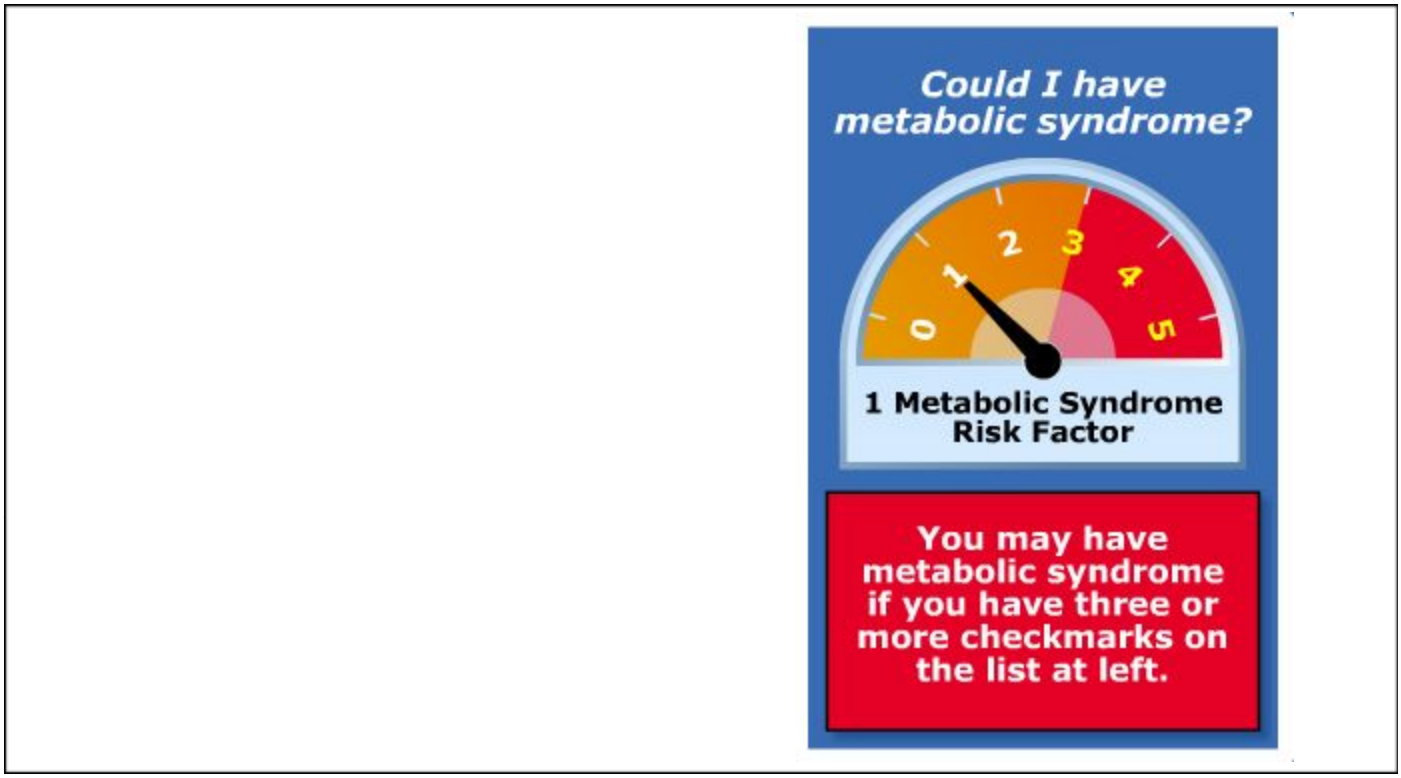
4.4 – Heart Intervention

- **EQs 1 & 2 – What is heart disease? What happens inside the heart to cause a heart attack?**



The arrows point to the site of a heart attack, where the heart muscle has died from oxygen deprivation. Normally, the area would look pink.

- **EQs 4-6 – What are risk factors for the development of heart disease? How can a person decrease his/her risk of heart disease? What is metabolic syndrome?**



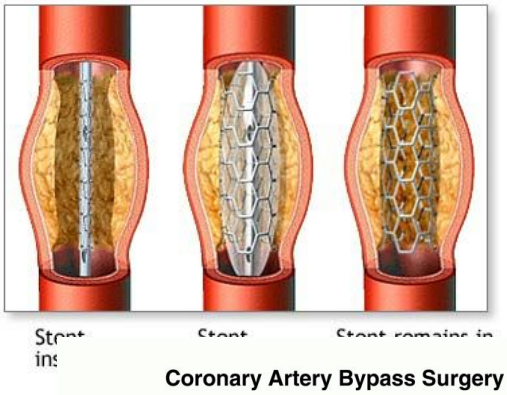
- **EQ 3 – How do doctors treat a blocked blood vessel?**

Diagnosis – Use an **angiogram** to detect a blocked blood vessel. A radioactive dye is injected into the blood and X-rays are used to view the passage of the blood through the blood vessels

Treatments

1. **Angioplasty** – A balloon is inserted via a catheter and is blown up to expand the artery to push the plague against the walls and restore blood flow

2. **Stent** – Wire mesh is inserted into the artery and compresses the plague. It then stays that way allowing for proper blood flow.



3. **Coronary Artery Bypass Graft (CABG)** – A vessel, usually from the leg, is taken and inserted on the heart to bypass the clogged area of the coronary artery to restore blood flow.