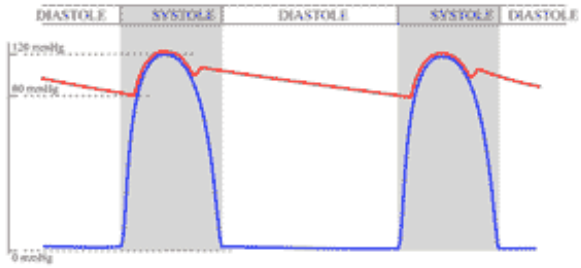
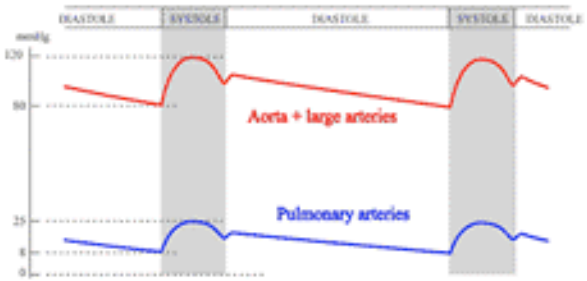
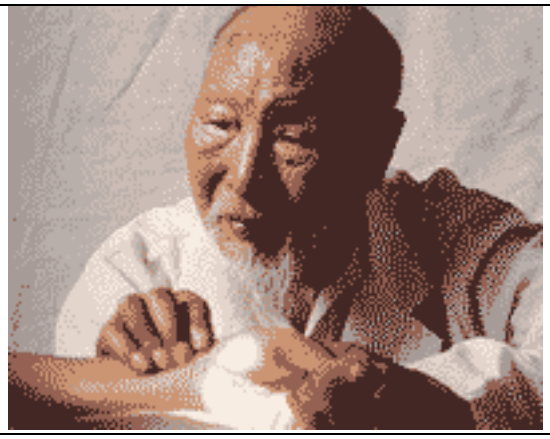
The Arterial System: the Large Arteries

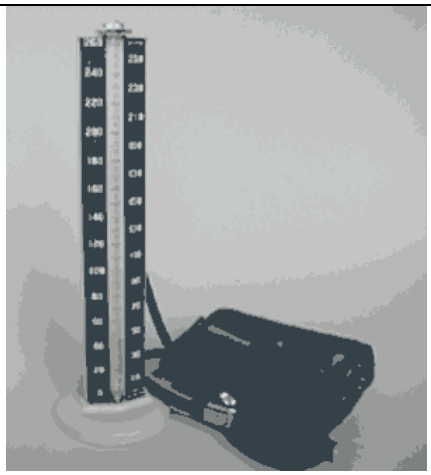
The arterial system consists of all the vessels that transport blood from the heart to the tissues. These vessels are located in the systemic circulation and the pulmonary circulation.

1. The task of the arterial system is actually very simple; transport blood from the heart to the tissues. Because the heart ejects blood at a high pressure, from the ventricles into the main arteries (aorta and pulmonary artery), and because the pressure in the tissue is low, blood then flows easily from high to low pressure	
2. The blood flow in the major arteries is **pulsatile**; that is, it increases with every heartbeat. Between the beats, the pressure decreases. The highest value is the systolic pressure and the lowest value is the diastolic pressure. Typical values are 120 mmHg for the systolic pressure and 80 mmHg for the diastolic pressure (in the aorta). This is written as 120/80 mmHg.	
3. You can feel this pulsatile action of the arteries when you feel the pulse, for example in the wrist.	

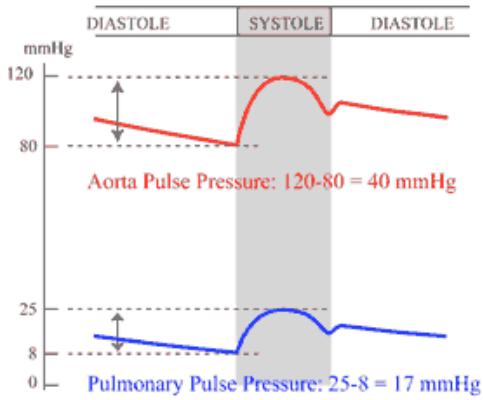
4.
The systolic and the diastolic pressures, together the blood pressure, are two of the most important **vital signs**. The blood pressure can be measured directly (but this is difficult, messy and bloody as you have to stick a needle inside an artery) or indirectly. The method to measure indirectly is with a sphygmomanometer (awful word!) and a stethoscope.

Vital Signs:
(in no particular order)

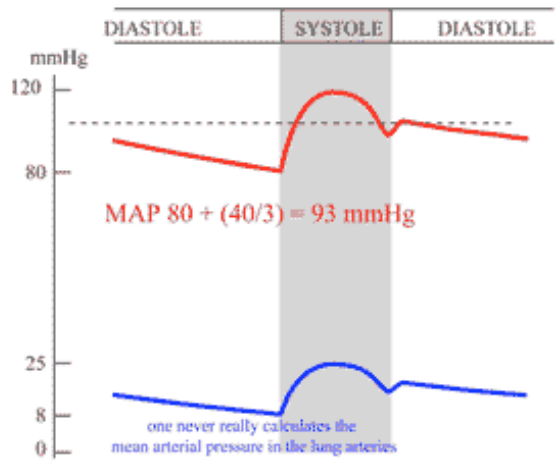
1. consciousness
2. body temperature
3. blood pressure
4. heart rate
5. respiration rate



5.
Another important value is the Pulse Pressure: this is the difference between the systolic pressure and the diastolic pressure. Example: if the systolic pressure is 120 mmHg and the diastolic pressure 80 mmHg, then the **pulse pressure** is 120-80 = 40 mmHg.



6.
Sometimes (not often), instead of the systolic and diastolic blood pressure, an average pressure is used. This is the Mean Arterial Pressure (=MAP) and is equal to the Diastolic Pressure + the Pulse Pressure divided by 3. Example: Systolic P = 120 mm Hg and Diastolic P = 80 mmHg, then the MAP = 80 + (120-80)/3 = 80 + 13 = 93 mmHg



B. Some common mistakes and problems:	
1. The blood pressure is always given as systolic/diastolic. Example: 120/80 mmHg. Never the other way around! (i.e. 80/120 mmHg). That would be extremely confusing.	2. Students often think that a blood pressure is always stable and fixed at 120 mmHg systolic and 80 mmHg diastolic pressure. This is not the case at all. The blood pressure varies considerably between every person and from moment to moment.
3. Students often think that the blood pressure declines a lot from the aorta to the arteries that are far away such as the arteries in the foot. This is not true. The decrease in blood pressure along the arteries is actually very small, only a few mm Hg. A significant decrease in blood pressure occurs at smaller vessel sizes and especially in the arterioles (see next page).	**4. Accuracy:** Manual measurements of the blood pressure (with the sphygmomanometer) are not very accurate. Therefore, values are often rounded to the nearest 5 mmHg. So a reading of 124.5/76.3 mmHg is nonsense. More realistic in this case would be: 125/75 mmHg.

C. A Detail:	
Some teachers like to talk about the windkessel function of the aorta. The word “windkessel” is from German and means "air-chamber". The windkessel function relates to the fact that when the blood is ejected from the left ventricle into the aorta, there is then such an increase in blood pressure that the walls of the aorta will expand. After ejection, during diastole, when the aortic valves have closed, the walls of the aorta, because they are elastic, will rebound or constrict and thereby push the blood further down the arteries. This action works like a second ‘pump’ but its magnitude is often exaggerated. This is not really an important factor.