

Lab no 3 & 4

Measurements of basic physiological parameters

Objective;

To practice the measurements of heart rate, respiratory rate, blood pressure and temperature.

1. Blood pressure (Bp);

Blood pressure is the force exerted by the blood against a vessel wall. The standard units for measuring blood pressure are millimeters of mercury (mmHg). Blood pressure is generated as a result to the contraction of ventricles. Blood pressure rises to about 120 mmHg during systole (contraction) and drops to about 80 mmHg during diastole (relaxation). Consequently, Systolic blood pressure; the vascular pressure following contraction of the heart. Diastolic blood pressure; the vascular blood pressure following relaxation of the heart.

Normal values; arterial blood pressure 120/80 mmHg.

Increased \longrightarrow Hypertension

Decreased \longrightarrow Hypotension

Factors that increase blood pressure	Factors that decrease blood pressure
a. Increased cardiac output	a. decrease cardiac output
b. Increased peripheral vascular resistance	b. decrease peripheral vascular resistance
c. Increased blood viscosity	c. decrease blood viscosity
d. Increased blood volume	d. decrease blood volume

Measurement of indirect arterial blood pressure;

A cuff with pressure gauge attached around the upper arm and the cuff is inflated to a pressure higher than the arterial pressure, thus occluding the arteries of the arm and causing a cessation of blood flow to the forearm. The pressure in the cuff is gradually lowered until blood once more flows into the forearm and the pressure in the cuff, when the flow begins, is equal to the systolic pressure in the artery. Thus, by reading the pressure in the sphygmomanometer cuff at the moment that blood flow in the forearm resumes, an indirect measurement of systolic pressure in the artery can be made. The resumption of blood flow into the forearm can be detected either by, feeling the pulse in the wrist and noting when a beat can again be felt in the artery (*the palpatory method*), or by placing a stethoscope on the brachial artery just below the pressure cuff and listening for the sounds made as blood flow resumes (*the auscultatory method*). Detection of the sounds is easier when working in relatively quiet surroundings.

Use of sphygmomanometer;

A sphygmomanometer consists of a pressure cuff, an attached bulb that is used to inflate the cuff, and a gauge that records pressure in the cuff. Before using a sphygmomanometer to measure blood pressure, always open the valve (near the rubber bulb) and press on the cuff to force out any air that might be trapped inside. If the cuff has an arrow on it, it is placed on the arm with the arm over the brachial artery (figure no.27). After the cuff is in place on the arm, the cuff is inflated by closing the valve near the bulb and then pumping the bulb. The bulb is pumped until pressure in the cuff is higher than the arterial pressure is expected to be. The pressure in the cuff is then gradually lowered by partially opening the valve. As pressure in the cuff decreases, evidence of resumption of blood flow to the forearm is sought by using either the auscultatory method or the palpatory method. When the pressure cuff is on a subject's arm, it should be inflated for no more than a minute or two at a time. If a difficulty is encountered in taking a blood pressure, deflate the cuff, wait a minute or two and try again. Press all air out of the cuff and replace the sphygmomanometer in its case after use.

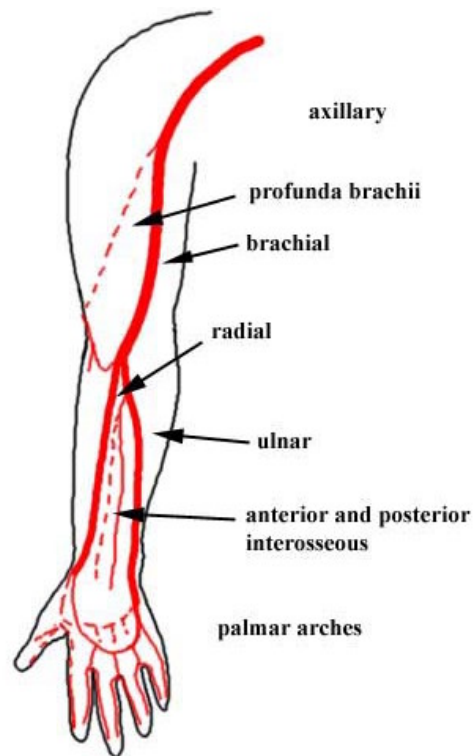


Figure ; arterial circulation of the arm

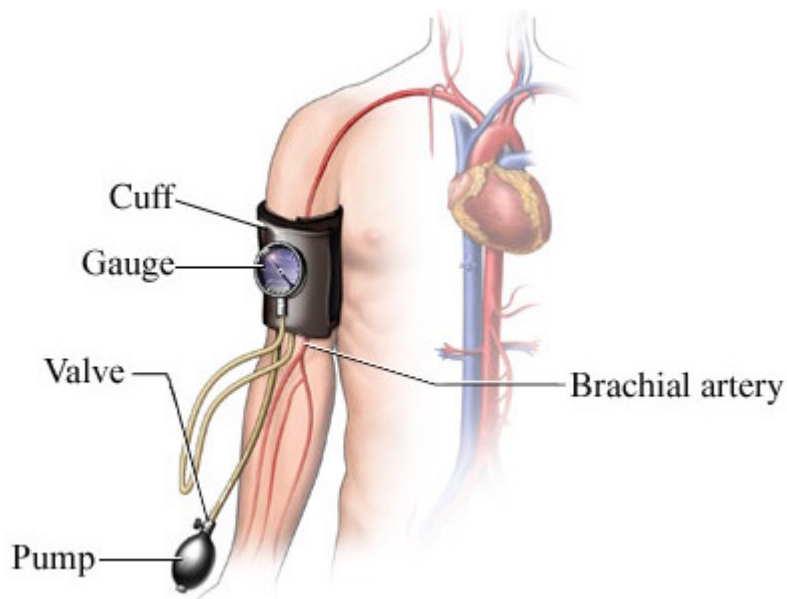
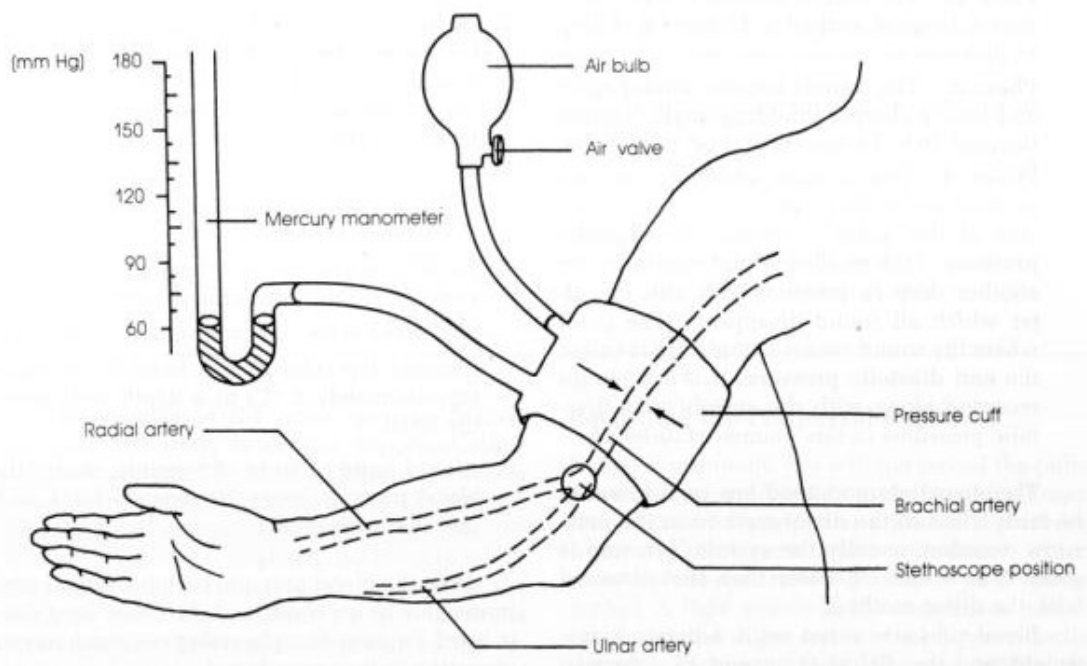


Figure ; The position of the cuff

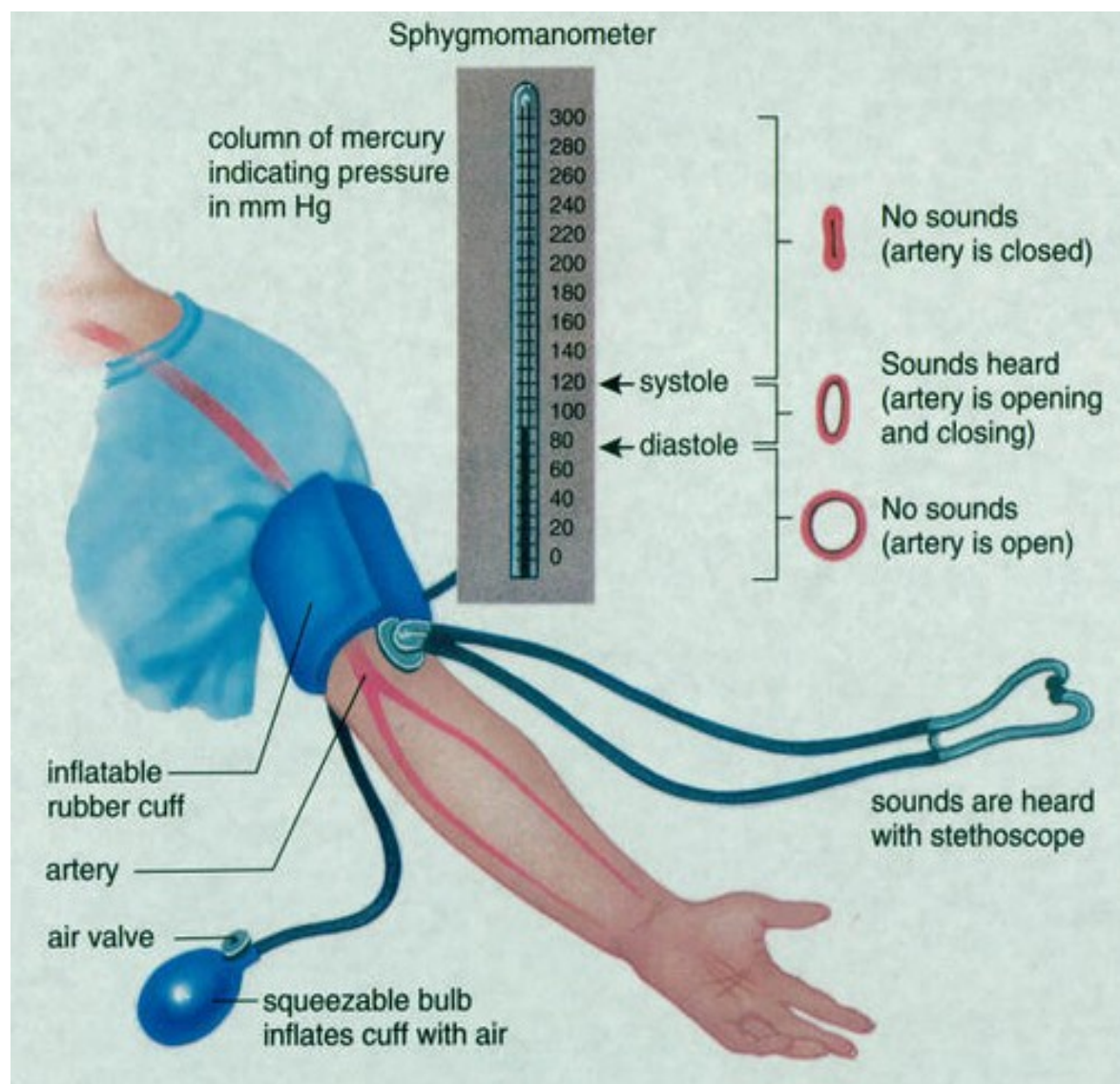
Procedure;**I. Blood pressure measured by the palpatory method.**

Locate the radial (or ulnar) pulse at the wrist of the subject (figure no.27). Feel the pulse with your fingers, not your thumb, if you use your thumb, you will detect a pulse in your own hand. Place the pressure cuff on the upper arm and inflate it to a pressure that is higher than you expect the subject's arterial pressure to be. While watching the pressure gauge, release the pressure valve just enough to allow pressure to be falling in the cuff. With your own hand on the subject's wrist, note when a pulse is felt and at the same instance read the pressure from the gauge and record this pressure as the subject's systolic pressure. Using the palpatory method, repeat the blood pressure measurement at time or two. Usually this is not the perfect and the preferred method of measuring arterial blood pressure, since it provides no means for measuring diastolic pressure and, in addition, the readings may be slightly low because the initial blood flow through the artery as the cuff pressure is decreased may not result in a detectable pulse.

**II. Blood pressure measured by the auscultatory method.**

Locate a pulse in the subject's brachial artery just below the pressure cuff. You may feel the pulse in this artery or, with the subject's arm extended you may be able to detect the pulse visually at this point. Inflate the pressure cuff to a pressure higher than expected arterial pressure, place the stethoscope over the point where a pulse was located in the brachial artery, and slowly turn the pressure valve of

the sphygmomanometer to deflate the pressure cuff. While watching the pressure gauge, listen with the stethoscope for sounds emanating from the brachial artery. When a sound is first detected, read the pressure record on the gauge. This pressure represents systolic pressure; continue to listen to the sounds. They will grow louder, then softer, and then disappear. The pressure in the cuff at the time the sounds grow softer, shortly before disappearing, is used as a measure of diastolic pressure. Since this change in quality of the sounds is difficult to detect without some practice, you can instead the pressure at the time the sounds disappear as a measure of diastolic pressure. Finally record systolic pressure over diastolic pressure. For example; 116/75 (Systolic/diastolic).



2. Heart rate (HR);

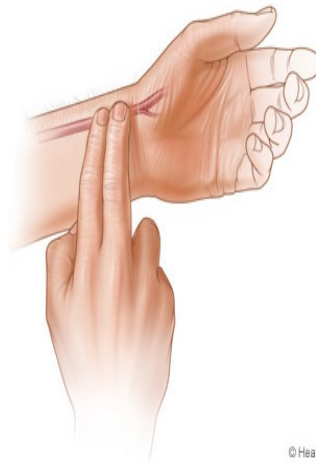
Heart rate is the number of heart beats per minute. This parameter reflects the physiological activity of the cardium.

Normal values: 60-80 beats/minute.

Increased in heart rate \longrightarrow Tachycardia.

Decreased in heart rate \longrightarrow Bradycardia.

Heart rate could be measured directly on the heart or indirectly by pulsation of any artery figure no. 26. The most convenient is to lay the finger (not the thumb) over the radial artery.



© Healthwise, Incorporated

Note that; cardiac output (CO); is the amount of blood ejected from the left or the right ventricle into the aorta each minute.

Cardiac output can be determined by;

1st. The volume of blood pumped by the ventricle per beat (stroke volume).

2nd. The number of heart beat per minute (heart rate).

In a resting adult, stroke volume average is 70ml/beat and heart rate average is about 75beat/minute. Consequently;

Cardiac output (ml/min) = SV (70ml/beat) x HR (75beat/minute)

CO = 5250ml/min. Or 5.25liters/min.

3. Body temperature (T);

Temperature is the hotness or coldness of a substance. A person's body temperature remains relatively stable despite internal extremes (for example, metabolic changes) or external conditions (for example, climatic temperature). Temperature-control mechanisms keep the body's core temperature (temperature of deep tissues) in a relatively constant range 37 °C. The body's surface temperature rises and falls with the temperature of the environment. A thermometer registers the body's core temperature.

Normal value: 37 °C or 99.6 oF

$$C = 5/9 (F-32) \quad \& \quad F = (9/5 \times C) + 32$$

When the body's core temperature rises above normal → Hyperthermia.

When the body's core temperature falls below normal → Hypothermia.

Using a clinical thermometer, we can determine the following temperature sites;

- Orally
- Axillary
- Rectally

Instruction for taking body temperature;

- Ingest no food nor drink within 15 minutes prior to taking temperature.
- Do not smoke within 15 minutes prior taking temperature.
- Shake thermometer down to 35 °C the preceding day. If not, wait five minutes after shaking it down.
- Use a thermometer marked "oral", insert thermometer under tongue and close mouth. Leave thermometer in mouth for 3 full minutes. It is best to be reclining, next best is sitting quietly, engage in no other activities while taking your temperature.
- Read thermometer as precisely as you can. Holding thermometer at eye level directly in front of one is best. Record temperature and time directly on your record. Shake down and store the thermometer.



4. Respiratory Rate (RR);

Respiratory rate is the number of breath per minute. The major function of the respiratory system is to supply the body with oxygen and dispose of carbon dioxide. Breathing is a rhythmic process controlled by several factors. Change in the rate and depth of breathing are so finely regulated that the needs of the body are usually well-served. Among the factors that regulate the rate and depth of breathing are;

- a. The amount of carbon dioxide in the blood
- b. The amount of oxygen in the blood
- c. The pH of the blood

Note;

⇒ Any state in which an inadequate amount of oxygen is delivered to body tissues is called hypoxia.

⇒ If there is excess in the amount of carbon dioxide in the blood this state is called hypercapnia.

These factors change with a change in body activity and the relative effectiveness of some of these factors in controlling breathing will be examined in this exercise. A change in rate and/or depth of breathing changes the *respiratory minute volume* (the amount of air taken into the lung in a period of 1 minute).

Normal physiological value: 14-18 breaths/minute.

Increased in rate & depth —————→ Hyperventilation.

Decreased in rate & depth —————→ Hypoventilation.

These could be measured by observation of chest movements per minute.