Protocol 2: Measuring Blood Pressure

Protocol 2.1: Via Auscultation (listening through stethoscope)

The estimate of blood pressure is obtained by cutting off blood flow with a known pressure (measured by the sphygnomanometer) and slowly releasing pressure until blood pressure is strong enough to counteract the pressure of the cuff. The stethoscope is used to identify the pressure at which flow is restored, by listening for the sounds.

The cuff is placed on the upper arm and inflated to stop arterial blood flow. The cuff creates a high pressure that causes the brachial artery to collapse, stopping blood flow. It is important to release the pressure in the cuff slowly, so as to distinguish systolic and diastolic pressure. When the systolic pressure in the artery is greater than that in the cuff, blood begins to spurt through the partially collapsed artery. This can be heard through a stethoscope as sharp, tapping sounds (Korotkoff sounds), at which stage cuff pressure read as systolic pressure. As cuff pressure is reduced further, the sounds increase in intensity and then suddenly become muffled. Cuff pressure at the point of sound muffling is taken to approximate diastolic blood pressure. As cuff pressure is further reduced much below diastolic pressure, the sounds disappear completely, and normal flow through the artery is re-established. Since the disappearance of sound is easier to detect than muffling, and since the two occur within a few millimeters of mercury pressure, the disappearance of sound is commonly used to determine diastolic pressure.

!!!! Warnings !!!!

This procedure involves stopping blood flow to the arm, which can be painful and potentially dangerous if prolonged or done improperly. NOTE:

1. Any students with a known medical condition that affects their circulation (i.e., hypertension, heart condition), should not participate as volunteers.
2. Do a dry run without cutting off the circulation of the volunteer. Make sure you understand the step-by-step details before attempting it on a person.
3. Do not leave the cuff inflated for a prolonged time (i.e., more than 60 seconds).
4. **Deflate the cuff as soon as** you have acquired the data (don't leave it inflated!!)
5. The volunteer should reestablish blood flow in their arm between measurements by flexing and extending his or her fingers. Rest if needed. Alternate volunteers to maximize breaks between measurements on each person.
6. Medical interpretation of the lab results are not warranted because of potential operator error. Please see a medical professional if you have any concerns about your blood pressure.

Using a stethoscope

A stethoscope is basically a hollow endpiece connected by hollow tubes to earpieces (Figure 1). Most stethoscopes have an endpiece with a flat diaphragm and a concave bell, only one of which is directly connected to the earpieces at any one time. The endpiece can be turned 180° to change the working side. In most stethoscopes, the connection bends away from the side of the endpiece that

should be placed against the skin. The bell is generally better than the diaphragm for these lab sessions because it reduces room noise. (If you have the connection the wrong way around, you will hear only room noise.) *The earpieces should point slightly forward to match the direction of the external auditory canal.*

Figure 1. The correct use of a stethoscope: note the angle of the connection to the endpiece; it shows that the bell is currently selected.

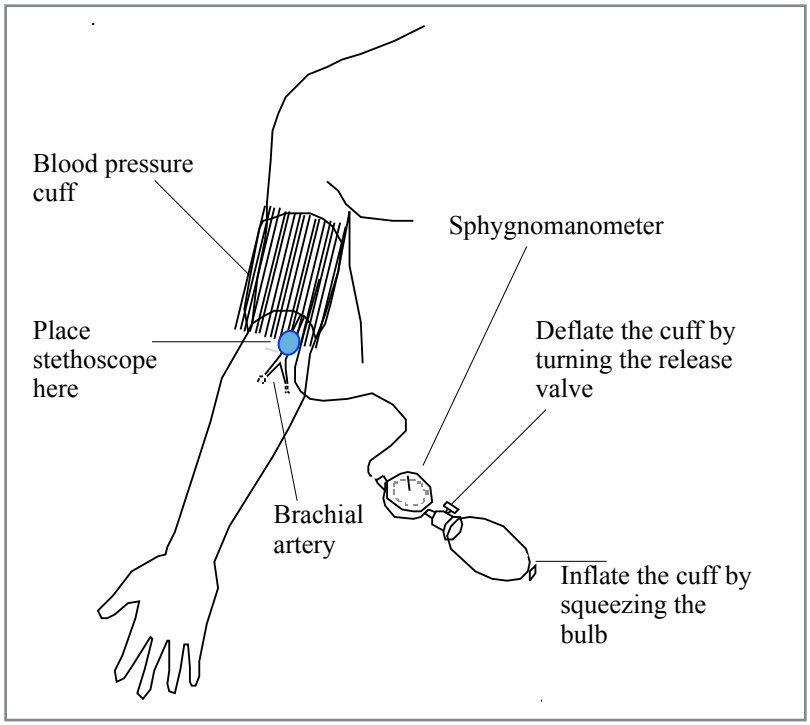
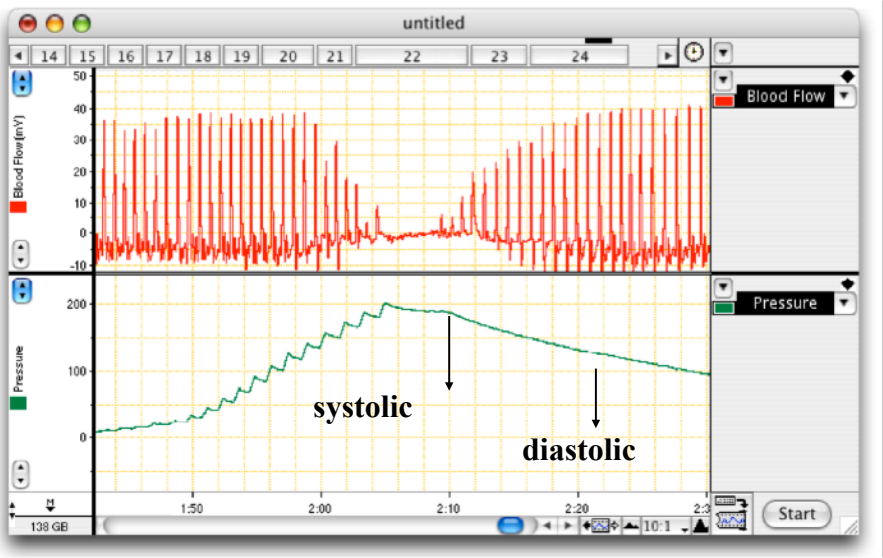


Figure 2. Placement of the cuff and stethoscope.

Procedure

1. Place the blood pressure cuff around the upper portion of the arm of the volunteer, between the elbow and the shoulder.
2. Place the bell of the stethoscope over the brachial artery, as shown in Figure 2. The artery lies medial to the biceps tendon, just above the elbow crease.
3. Inflate the cuff until the pressure reaches approximately 180 mmHg.
4. Slowly reduce the pressure in the cuff (~1 to 2 mmHg per second) while listening through the stethoscope for Korotkoff sounds.
5. Note the pressure value at which regular tapping sounds are first heard. This is the systolic pressure (see Figure 3).
6. Continue slowly reducing cuff pressure, listening for the cessation of sound which occurs at diastolic pressure.
7. **Completely deflate the cuff**. Work quickly — do not cut off circulation for long.



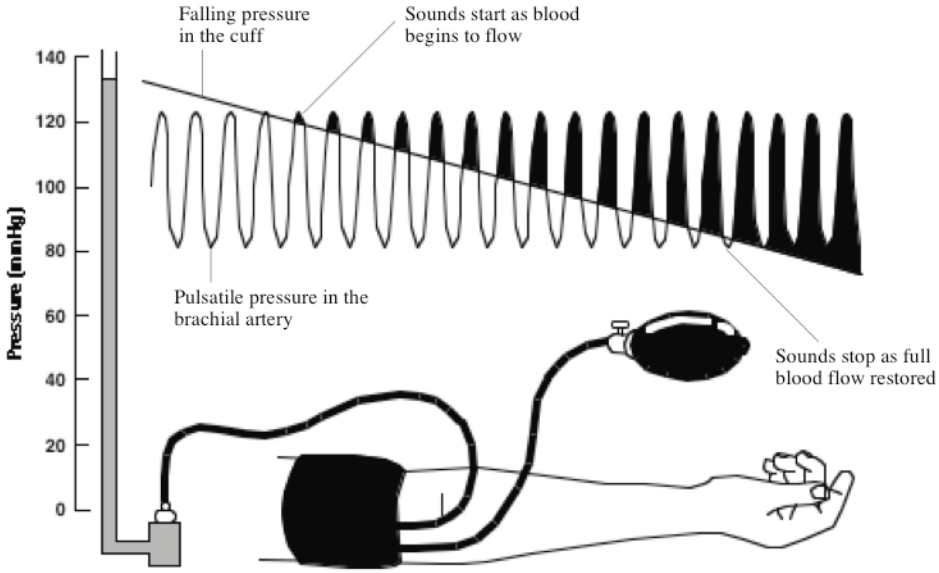


Figure 3. A graphical summary of determining blood pressure via auscultation.

8. Repeat the procedure using other volunteers until you feel confident in measuring blood pressure. Allow the volunteers one to two minutes between procedures to recover.

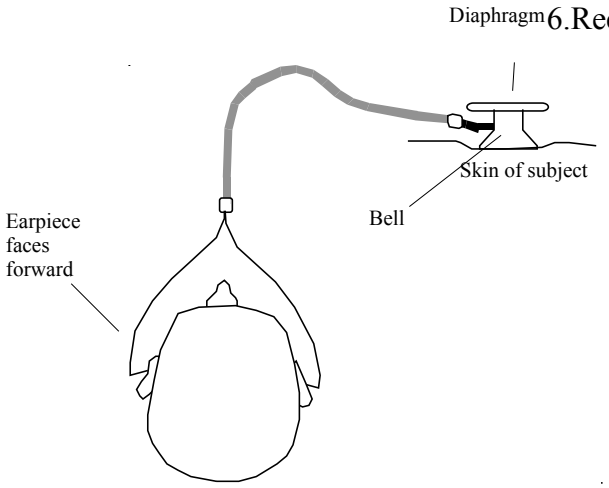
Protocol 2.2: Measuring Blood Pressure Using PowerLab

Equipment

1. Use “Blood Pressure” settings to start Chart software.
2. Setup **Finger Pulse transducer** on Input 1 (protocol 2)
3. Attach **sphygmomanometer transducer** to Input 2 (pod input). Ensure that the Luer-Lok connections on the force transducer at the sphygnomanometer are tight.

Procedure

4. Attach the transducers to the volunteer to record blood flow (using the finger pulse transducer) on the same arm as the blood pressure cuff.
5. Adjust the range of Channel 1 so that the blood flow trace occupies 1/2 - 2/3 of the full scale when the volunteer is resting with both hands in his or her lap.



6. Record the finger pulse for about ten seconds, and comment (i.e., "resting pulse"). Inflate the cuff until the pulse signal disappears at around 180-200 mmHg on the dial. Hold for a few seconds, then slowly release the pressure (Figure 4). **Completely deflate the cuff.**

Figure 4. Some typical results from Exercise 2, with systolic and diastolic pressures indicated.

7. If the maximum pressure in step 3 is outside of the 180-200mmHg range, *Calibrate the sphygnomanometer:*

1. "Pressure" pull-down menu > "Units Conversion." Clear old calibration: > "Off" > "OK." The values are now in mV. Look at the chart, write down the baseline mV (=0 mmHg) and maximum mV(~200 mmHg). Return to the "Units Conversion" window and enter these values for Point 1 and Point 2 (Figure 5). Repeat if fussy.

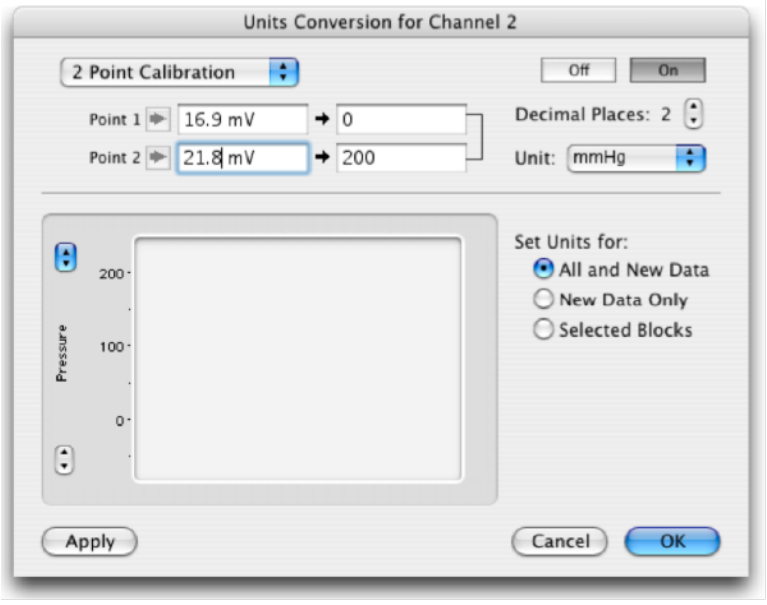


Figure 5. Units conversion window.

5. Repeat recording (step 3), but this time listening for blood flow with the stethoscope. Mark a comment when the **systolic pressure**

is first heard through the stethoscope. Mark another comment when the **diastolic pressure is reached.** Continue to deflate and record for a few seconds and then **quickly and completely deflate the blood pressure cuff.**

Notes:

1. Ensure the volunteer is relaxed and sits as still as possible to minimize signal noise.
2. ****Remember to release the pressure EACH TIME you are done taking data, if you leave it on for too long it could cause pain and injury****
3. If you are unable to hear the pulse through the stethoscope, try reading the needle on the sphygnomanometer, when it starts to "bounce", this is the systolic reading, and listen carefully for the sound. When the needle stops "bouncing" this the diastolic reading. The volunteer may also be able to feel the start of the systolic readings when they start feeling the pulse and the diastolic reading when they can no longer feel the pulse. There are multiple checks!