EXPERIMENT 1

ELECTROCARDIOGRAPHY

The purpose of this experiment is to introduce you to the techniques of electrocardiography and the interpretation of electrocardiograms. In Part A of the experiment, you will record and analyze a normal electrocardiogram. In Part B, you will be introduced to the operation of the MacLab computer program that will be used throughout the lab part of the course. In Part C, a number of abnormal ECG's will be presented for you to analyze and determine the causes of the abnormalities.

PART A: Recording a Normal Electrocardiogram

Each student should record the ECG of one of the members of the lab group and have their own ECG recorded.

The subject should be supine and relaxed at all times. Attach the four limb leads to the appropriate limbs as marked on each lead (RA = right arm; LL = left leg, etc.). Also attach the six chest leads using the electrode pads and appropriately marked leads. Interference may occur if the subject contracts his muscles while the ECG is being recorded. Thus, it is important that the subject remain relaxed while the ECG is recorded. If the subject’s skin is greasy or if the hair is very thick the contact may not be well established. This results in a noisy, erratic pattern on the ECG. Should this happen, check each lead to make sure that it is secure.

Record a few centimeters (about 4 or 5 complexes) of each:

1. the three standard limb leads (I, II, and III)
2. and the three augmented leads (aVF, aVR and aVL).

At the beginning and end of the recording for each person, set the recorder in the standardization position (STD) and depress the standardization button. The standard is 1 mV, and should yield a deflection of 10 mm at a recording sensitivity of 1.
Record the six unipolar chest leads. The positions for the chest leads are (Figure 1):

**BIPOLAR LIMB LEADS**

LEAD 1  
LEAD 2  
LEAD 3

(V)OUT  
(V)OUT  
(V)OUT

**(AUGMENTED) UNIPOLAR LIMB LEADS**

LEAD aVR  
LEAD aVL  
LEAD aVF

(V)OUT  
(V)OUT  
(V)OUT
V₁: Fourth intercostal space to the right of the sternum.
V₂: Fourth intercostal space to the left of the sternum.
V₃: Midway between V₂ and V₄.
V₄: Fifth intercostal space at the mid-clavicular line.
V₅: Anterior axillary line; same level as V₄.
V₆: Midaxillary line; same level as V₄ and V₅.

In which lead(s) does the QRS complex go from a primarily negative to a primarily positive deflection? What is the explanation for this change in the direction of deflection? Which lead has the largest negative deflection? What is the explanation for this?
Mount your own ECG in the folder provided. Recall that the standard paper speed is 25 mm/sec. This means the time between two heavy vertical lines is 0.2 sec (Figure 2); each mm is 0.04 sec. The standard voltage calibration is 1 mV/cm. The ventricular rate and QRS complex duration can be calculated from the traces obtained on lead II.

**Measure and record on the folder:**

1. Heart rate
2. P-R interval: Beginning of P wave to beginning of the QRS complex.
3. QRS Duration
4. Q-T interval: Beginning of QRS complex to the end of the T wave.

![ECG Traces](image)

**FIGURE 3**

Total Voltage = 0.9 - 0.1 - 0.3 = 0.5 mV

Also calculate the mean electrical axis of the heart. Be sure to get the sum of all of the positive and negative deflections to determine the total voltage in each lead. A **positive** deflection is measured from the **top** of the isoelectric line to the peak of the deflection. A **negative** deflection is measured from the **bottom** of the isoelectric line to the peak of the deflection (Fig. 3).
Plot the potentials obtained from Leads I and III on the graph in Figure 4. Calculate the mean electrical axis. Record the value on the mean electrical axis on the folder.

Are the values that have been recorded in the folder within normal limits?
PART B: EXPERIMENT USING THE MACLAB

REFER TO GENERAL INSTRUCTIONS FOR MACLAB pp.
All these measurements should be carried out on one subject from each group.

Computer:
   Channel 1: ECG lead 2
   Channel 2: Finger pulse
   Channel 3: Heart Rate

Connect the ECG leads for lead 2. Attach finger pulse.
Check computed input for Heart Rate (HR). Learn how to verify.

1. Have the subject sit still. Record baseline control values. Alter sensitivity till traces are adequate height. Make a comment on the comment line (e.g. "CONTROL").
2. Have the subject take a deep breath and hold than push against a closed glottis. Record and make a comment (e.g. “Valsalva maneuver “)
3. In zoom window observe overlay and layered look.

LAB REPORT: DUE BY 1:00 DAY FOLLOWING LAB
BOX OUTSIDE PHYSIOLOGY OFFICE 7205 7TH FLOOR

1 PER GROUP : PRINT OUT AND TURN IN :
ZOOM WINDOW OVERLAY OF ECG AND PULSE

EACH PERSON : TURN IN
ECG MOUNTED IN FOLDER WITH ALL VALUES CALCULATED.