Experiment HH-11: ECG ~ Simulations and Comparisons

Exercise 1: The ECG in a Resting Subject

Aim: To measure the ECG in a resting individual.

Procedure

1. Click on the Record button, located on the upper right side of the LabScribe Main window (Figure HH-11-L1). The signal should begin scrolling across the screen.

Note: *If the user clicks the Record button and there is no communication between the iWorx unit and computer, an error window will appear in the center of the Main window. Make sure the iWorx unit is turned on and connected to the USB port of the computer. Click OK and select the Find Hardware function from the LabScribe Tools menu.*

2. Click on the AutoScale button at the upper margin of the ECG and Heart Rate channels. Your recording should look like Figure HH-11-L1.
    - If the signal on the ECG channel is upside down when compared to trace in Figure HH-11-L1, click on the downward arrow to the left of the channel title and select the Invert function. The trace should now look similar to the one in the figure.
    - If a larger ECG signal is required, the electrodes can be moved from the wrists to the skin immediately below each clavicle.
3. When you have a suitable trace, type <Subject's Name> Resting ECG in the Mark box to the right of the Mark button. Press either the Enter key on the keyboard or the Mark button on the toolbar to attach the comment to the data. Record for 2 to 3 minutes.
4. Click Stop to halt recording.

Figure HH-11-L1: ECG, and heart rate displayed on the Main window.

5. Select Save As in the File menu, type a name for the file. Choose a destination on the computer in which to save the file, like your lab group folder). Designate the file type as *.iwxdata. Click on the Save button to save the data file.

Data Analysis

1. Scroll through the recording and find a section of data with six exemplary ECG cycles in succession.
2. Use the Display Time icons to adjust the Display Time of the Main window to show the six complete ECG cycles on the Main window. Six adjacent ECG cycles can also be selected by:
    - Placing the cursors on either side of a group of six complete ECG/Pulse cycles.
    - Clicking the Zoom between Cursors button on the LabScribe toolbar to expand the segment with the four selected ECG/Pulse cycles to the width of the Main window.
3. Click on the Analysis window icon in the toolbar (Figure HH-11-L2) or select Analysis from the Windows menu to transfer the data displayed in the Main window to the Analysis window (Figure HH-11-L3).

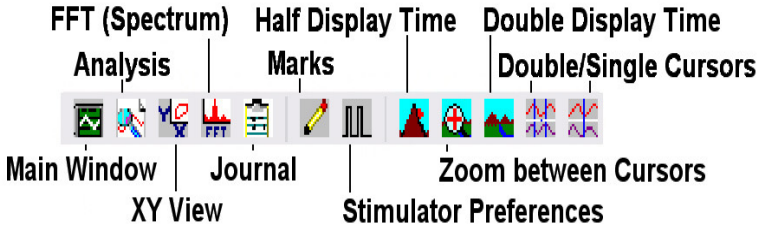

Figure HH-11-L2: The LabScribe toolbar.

4. Look at the Function Table that is above the uppermost channel displayed in the Analysis window.
5. The names of the mathematical functions used in the analysis: V2-V1, T2-T1 and Mean appear in this table. The values for V2-V1, T2-T1 and Mean from both channels are seen in the table across the top margin of each channel.
6. Once the cursors are placed in the correct positions for determining the specific values for each ECG cycle, the values can be recorded in the on-line notebook of LabScribe by typing their names and values directly into the Journal, or on a separate data table (Table HH-11-L1) and Table HH-11- L2).
7. The functions in the channel pull-down menus of the Analysis window can also be used to enter the names and values of the parameters from the recording to the Journal. To use these functions:
    - Place the cursors at the locations used to measure the amplitudes and period of the ECG/Pulse cycle.
    - Transfer the names of the mathematical functions used to determine the amplitudes and time interval to the Journal using the Add Title to Journal function in the ECG Channel pull-down menu.

- Transfer the values for the amplitudes and beat period to the Journal using the Add Ch. Data to Journal function in the ECG Channel pull-down menu.

Figure HH-11-L3: An ECG recording displayed on the Analysis window. Peaks are labeled to show cursor positions.

8. Use the mouse to click on and drag the cursors to specific points on the ECG/Pulse recording to measure the following:
    - The R-wave amplitude. To measure the R wave amplitude, place one cursor on the Q wave that precedes the R wave and the second cursor on the peak of the R wave. The value for V2-V1 on the ECG channel is this amplitude. Measure the amplitudes of five additional R waves.
    - The beat period, which is the time interval between two adjacent R waves. To measure the beat period, place one cursor on the peak of a R wave and the second cursor on the peak of the adjacent R wave. The value for T2-T1 on the ECG channel is the beat period. Measure the beat period for five additional pairs of R waves.
    - The P-wave amplitude. To measure the P wave amplitude, place one cursor on the baseline that precedes the P wave and the second cursor on the peak of the P wave. The value for V2-V1 on the ECG channel is this amplitude. Measure the amplitudes of five additional P waves.
    - The T-wave amplitude. To measure the T wave amplitude, place one cursor on the peak of the T wave and the second cursor on the baseline after the T wave. The value for V2-V1 on the ECG channel is this amplitude. Measure the amplitudes of five additional T waves.
    - The P-R interval. To measure this time interval, place one cursor at the beginning of the P wave and the second cursor at the beginning of the QRS complex. The value for T2-T1 on the five additional ECG cycles.

- The Q-T interval. To measure this time interval, place one cursor at the beginning of the QRS complex and the second cursor at end of the T wave. The value for T2-T1 on the ECG channel is the Q-T interval. Measure this time interval for five additional ECG cycles.
- The T-P interval. To measure this time interval, place one cursor at the end of the T wave and the second cursor at the beginning of the P wave. The value for T2-T1 on the ECG channel is the T-P interval. Measure this time interval for five additional ECG cycles.

9. Calculate the following values and record your results into the Journal or on the data tables below:
    - The average beat period, in seconds/beat.
    - The heart rate, which is expressed in beats per minute and calculated from the average beat period by using the following equation:

Heart Rate (beats/minute) = 60 seconds/minute / # seconds/beat

Note: *Heart Rate can also be determined by looking at the Mean function on the Heart Rate Channel. The more data on screen - the more accurate the Mean heart rate. Double the display time to get at least 60 seconds of data on screen for a more accurate heart rate measurement.*

- The average P-R interval.
- The average Q-T interval.
- The average T-P interval.

Questions

1. What electrical and mechanical events take place during the R wave? P wave? T wave?
2. What other events are taking pace in the cardiovascular system during these individual waves?
3. What are the physiologic responses associated with the events in a cardiac cycle?
4. Explain how glands in the body can affect the cardiac cycle.
5. What external factors have an influence on normal cardiac rhythms?

Exercise 2: The ECG in Other Subjects

Aim: To measure ECG in three other subjects.

Procedure

Repeat Exercise 1 on three other subjects. Try to pick subjects of different age and gender than your own.

Data Analysis

Analyze the data for each subject using the same techniques used in Exercise 1.

Questions

1. Did you notice differences in the average wave amplitudes between subjects?
2. If so, what could cause the differences between these values?
3. Is the beat period or heart rate the same for each subject? What could cause any differences that you see?

Table HH-11-L1: Values of ECG Amplitudes at rest for all subjects measured.

	Self			Subject 1			Subject 2			Subject 3		
	Q-R	P Wave	T Wave	Q-R	P Wave	T Wave	Q-R	P Wave	T Wave	Q-R	P Wave	T Wave
Mean												

Table HH-11-L2: Values of ECG Intervals at rest for all subjects measured.

	Self			Number 1			Number 2			Number 3		
	P-R	Q-T	P-T	P-R	Q-T	P-T	P-R	Q-T	P-T	P-R	Q-T	P-T
Mean												
Mean R-R												
Mean Heart Rate												

Exercise 3: Using the iWorx ECG-SIM-1200

Aim: To observe and measure different ECG heart rhythms using the iWorx ECG-SIM-1200 electrocardiogram simulator.

Procedure

1. Attach ECG cable to the iWorx ECG-SIM-1200.
    - The red lead attaches to the snap electrode labeled RA (IWX/214) or LA (IXTA)
    - The black lead attaches to the snap electrode labeled LA (IWX/214) or RA (IXTA)
    - The green lead attaches to the snap electrode labeled LL

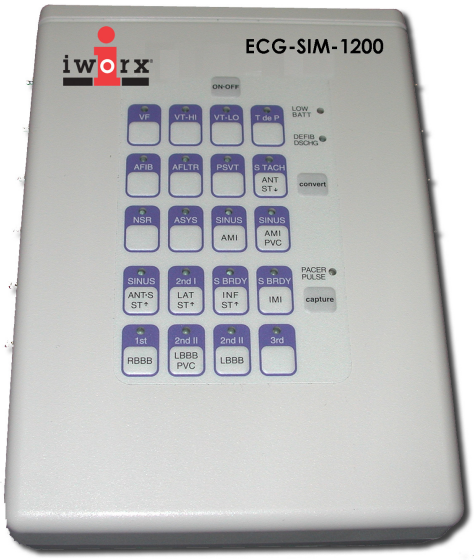

Figure HH-11-L4: The iWorx ECG-SIM-1200 Electrocardiogram Simulator.

2. Click on the Normal Sinus Rhythm (**NSR**) button. Click Capture to change the ECG pattern generated by the ECG simulator.
3. Type Normal Sinus in the Mark box to the right of the Mark button. Click on the Record button, located on the upper right side of the LabScribe Main window (Figure HH-11-L5). The signal should begin scrolling across the screen.
4. Immediately press either the Enter key on the keyboard or the Mark button on the toolbar to attach the comment to the data. Record for a minute or two.

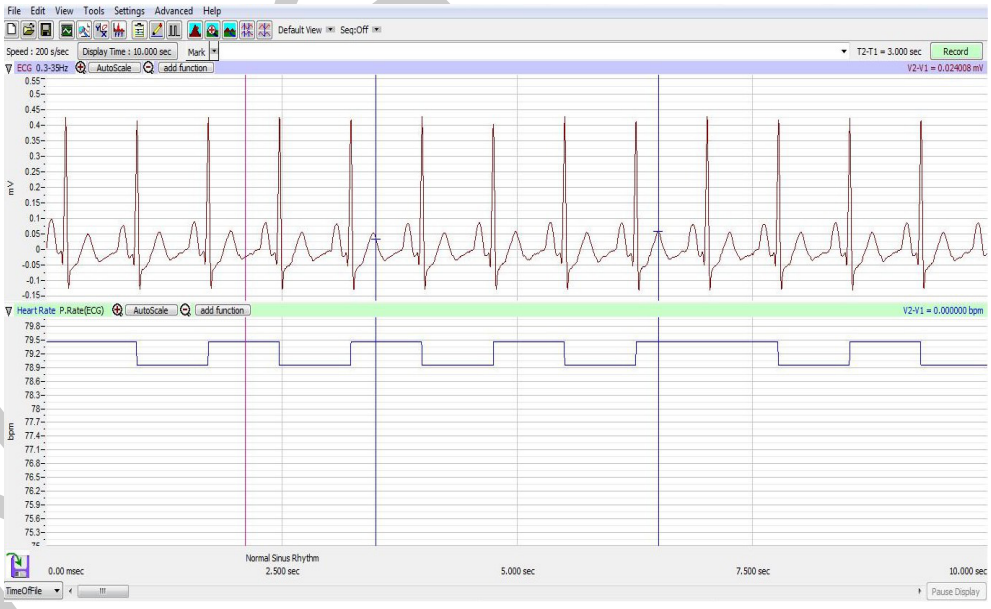

Figure HH-11-L5: Normal sinus rhythm as generated by the ECG simulator.

5. Click on the AutoScale button at the upper margin of both channels. Use the same techniques used in Exercise 1 to display the signals properly.
6. Select Save in the File menu on the LabScribe window.

Data Analysis

Analyze the data for Normal Sinus Rhythm using the same techniques used in Exercises 1 and 2.

- Record the data collected in your own data table or in the Journal.

Questions

1. How does the data collected from you and your other subjects compare to the data collected from the ECG simulator?
2. If there is a difference, what could be some contributing factors?

Exercise 4: Using the iWorx ECG-SIM-1200 to Record Other Cardiac Rhythms

Aim: To measure a variety of other cardiac rhythms using the electrocardiogram simulator.

Procedure

1. Repeat Exercise 3 testing at least three other abnormal cardiac rhythms.
2. Click on the button of the rhythm you would like to test, ex: Sinus Tach (**S TACH**).
3. Click Capture to change the ECG pattern generated by the ECG simulator.
4. Options include:
    - Sinus Tachycardia (Figure HH-11-L6)
    - Atrial Fibrillation (Figure HH-11-L7)
    - Toursade (Figure HH-11-L8)
    - Atrial Flutter
    - Many others
5. Mark the recording appropriately and record each abnormal rhythm for one to two minutes.

Data Analysis

Analyze the data for each abnormal cardiac rhythm using the same techniques used in the previous exercises.

- Be sure to keep track of what is different about each of the rhythms.
- Record this data is your own data table or in the Journal.

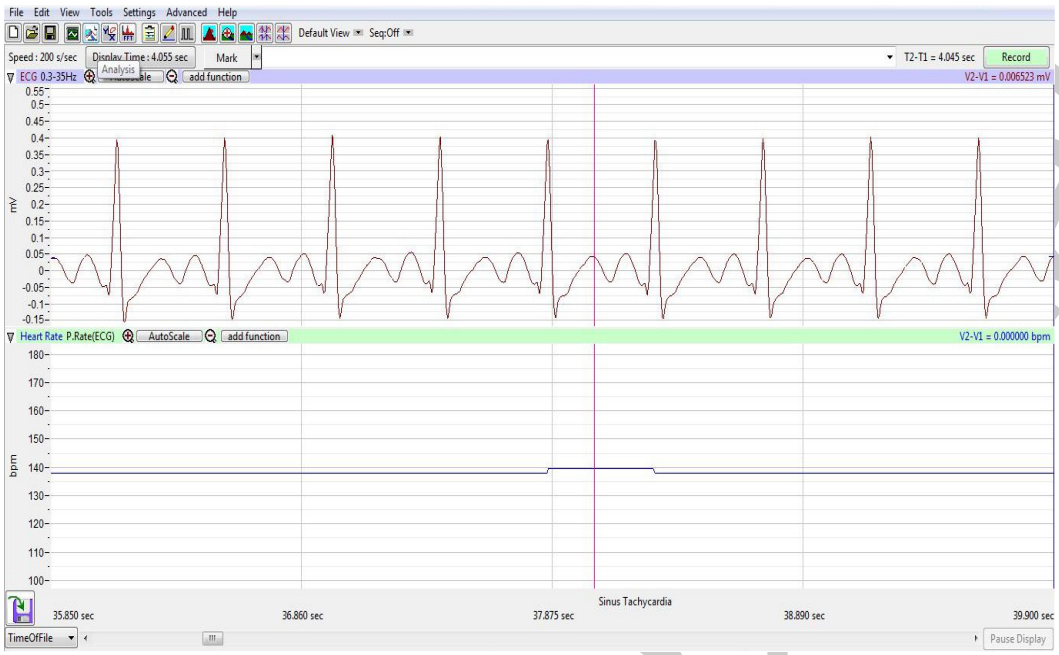

Figure HH-11-L6: Sinus Tachycardia

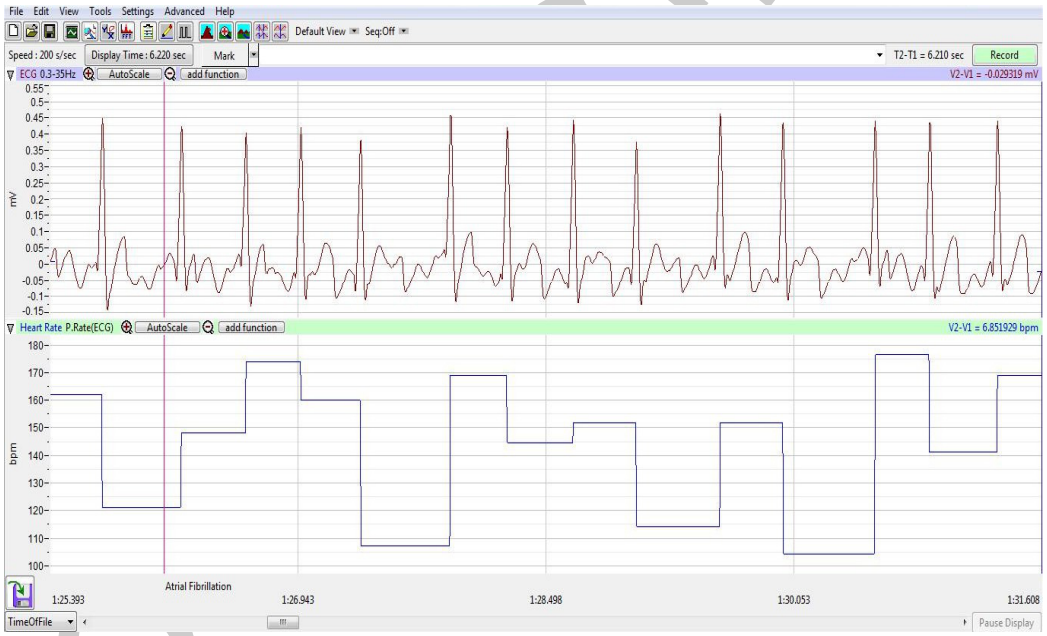

Figure HH-11-L7: Atrial Fibrillation

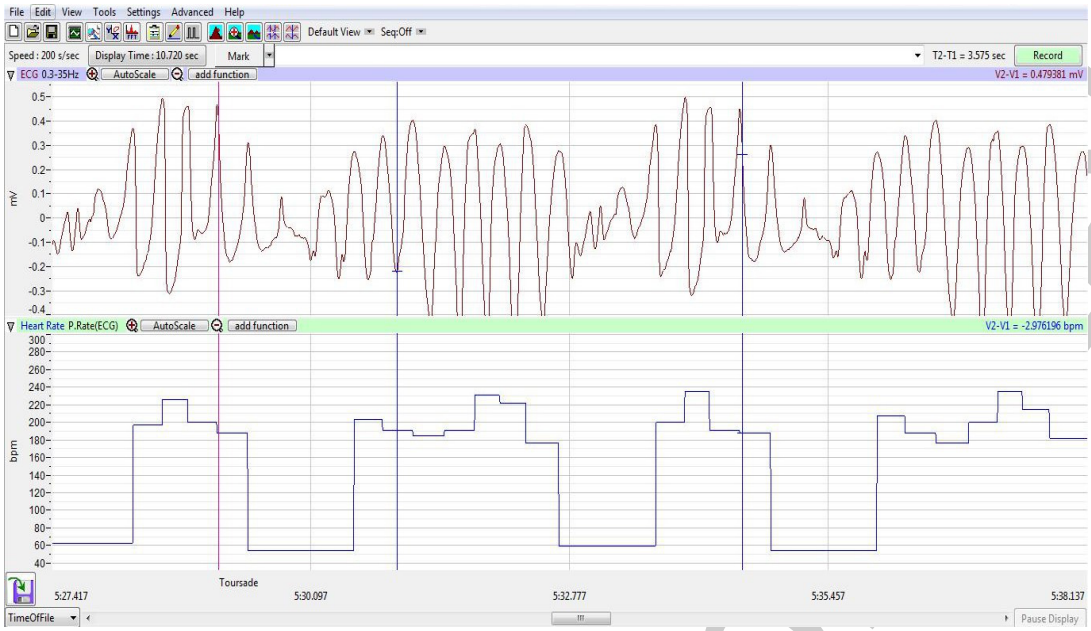

Figure HH-11-L8 Toursade

Questions

For each of the options chosen:

1. What is the major difference between this recording and the one of a normal ECG?
2. Explain what could be happening physiologically to cause the abnormality.
3. Explain what can be done to a patient experiencing this abnormal rhythm to get him/her back to a normal sinus pattern.