Globisens

Labdisc
activities

for Elementary School Science

Labdisc Activity
Our Heart Rate

Supporting Labdisc Data Logger, GlobiWorld and GlobiLab Software

For Elementary School Science

Our Heart Rate

Introduction

The heart is a powerful muscle, pumping blood and oxygen all around our body and yet we use this amazing organ to describe many other experiences and feelings too. When people say their heart is broken, they're really saying they feel very sad. Or if they place a hand on their heart they want you to know their words are absolutely true and almost everyone has drawn a picture of a heart to say they love someone.

When we are frightened, nervous or excited our hearts beat really fast and loud – sometimes we even hear our hearts beating inside our ears. People also say when they get a shock that their heart skipped a beat!

Our brain may process our thoughts and emotions, but our hearts are clearly responding to our feelings.

Muscle Power

Clench your fist and put it slightly to the left of the middle of your chest. That's about the size and position of your heart inside your body. Now squeeze your fist really tight and then release it. That's exactly how the heart muscle works - like a pump - filling with blood and then contracting to push the blood along. Your heart is one of the most important muscles in the body, working without a break, together with the lungs and blood vessels, to carry away waste and deliver oxygen and nutrients to every single cell.

The left side of the heart pumps blood full of oxygen from the lungs, taken in with every breath. At the same time, the right side of the heart is busy receiving all the blood that's been around the body delivering all of its oxygen. This blood gets pumped into the lungs where it is refilled with oxygen, ready to start the whole journey again.

Heart Beat

A complete cycle of pumping blood around our body is called heart beat. At rest, our heart beats between 60 to 80 times per minute. Although we go to sleep, our heart doesn't, and keeps beating throughout our entire life time – about 3 bilion times!

Our heart rate, or pulse is the number of beats per minute. The table below shows the normal heart rate of people at different ages.

Heart Rate Chart: Babies to Adults	
AGE	**Beats Per Minute (BPM)**
Babies up to one year	100 – 160
Children aged 1-10	60 – 140
Children aged 10+ and adults	60 – 100
Athletes:	40 – 60

The Experiment

In this activity we will record our heart rate before and after exercise using an ear clip probe. This probe measures how our ear lobe, or even our finger, changes its light transparency when blood flows through it.

Equipment Needed

- No equipment is needed

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Labdisc Setup

1. Turn on the Labdisc by pressing the On/Off key

2. Rotate the Labdisc plastic ring to expose the sensors

3. Connect the ear-clip _____ to the Labdisc input located under

   the HEART RATE key.

4. Connect the ear-clip to your pointing finger or ear lobe. Press the

   HEART RATE key on the Labdisc and wait three seconds. The Labdisc should beep at the same rate as your heart beat. Then after eight seconds your heart rate will be displayed on the LCD screen.

5. If the Labdisc doesn't beep, make sure the ear clip is well positioned on your finger or ear lobe – as in the pictures below:

6. Connect the Labdisc to the computer either with the USB cable or through the wireless Bluetooth channel.

7. Click on the METER icon to open the METER view.

8. Use the bottom single METER icon to see only one meter on the screen.

9. A right mouse click on the body of the meter changes it to a digital meter, analog gauge or bar graph.

10. With a right mouse click over the sensor name select the Pulse -> heart rate sensor. The meter will show your current heart rate:
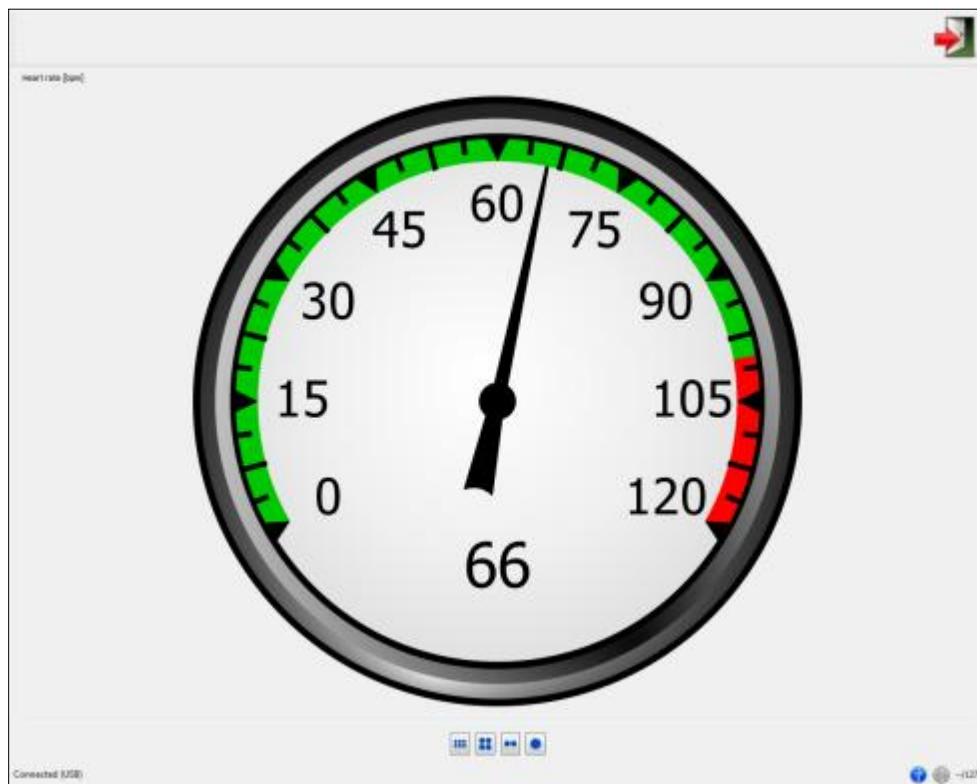
11. Connect the ear-clip to other students in your class, and compare their different heart rates.

> **Note**: Don't forget the Labdisc takes up to eight seconds to pick up your heart rate. For stable readings make sure not to move your finger or ear while measuring your heart rate

12. Click on the EXIT icon to close the METER view.

13. Now, let's investigate the changes in heart rate.
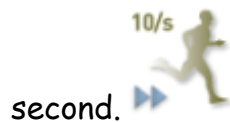
Experiment Procedure

1. Click the LAB icon to open the Lab software.

2. Click on the SENSOR icon and select the heart rate sensor.

 Make sure that this is the only selected sensor.

3. Click on the sampling rate icon triangle and select 10 samples per second.

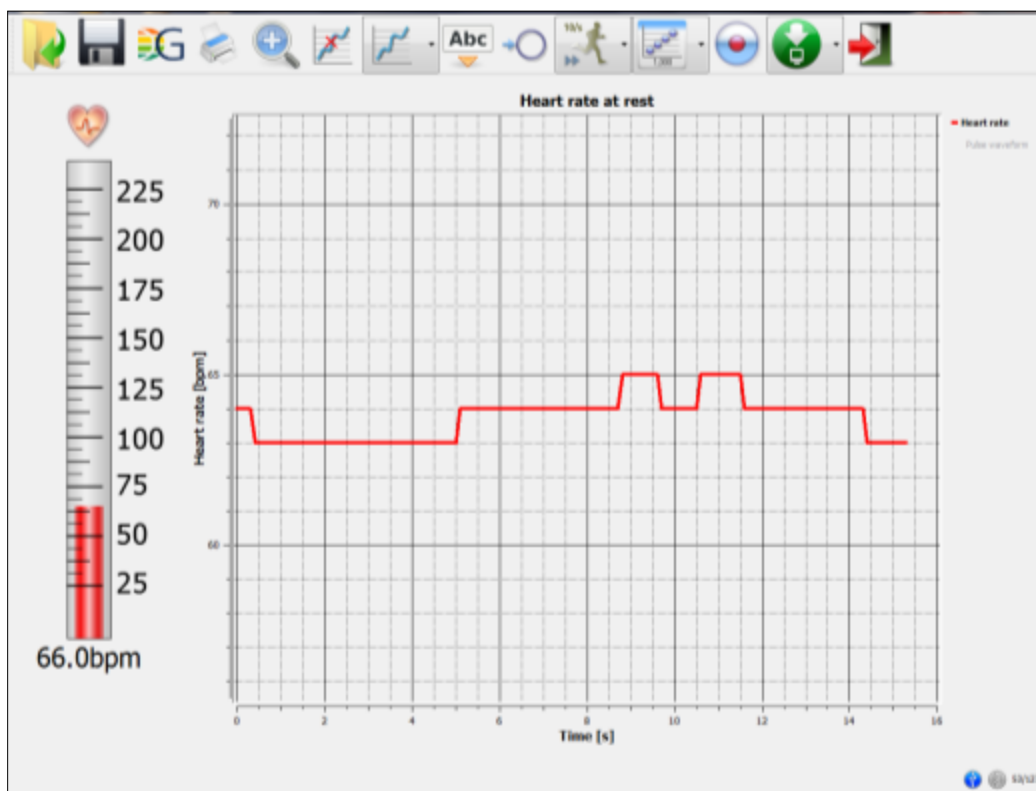4. Click on the amount of samples and select 1000 samples.

5. Click on the Display option triangle and then select the line graph option.

6. Click on the RECORD icon to start the experiment.

Data Analysis

The software displays the graph below.

A steady graph is shown on the screen describing your heart rate at rest. In this example the heart rate recorded was between 64 and 66 bpm (beat per minute).

1. To stop recording press the STOP icon.
2. With a right mouse click over the pulse waveform you can view the heart beats and their magnitude.
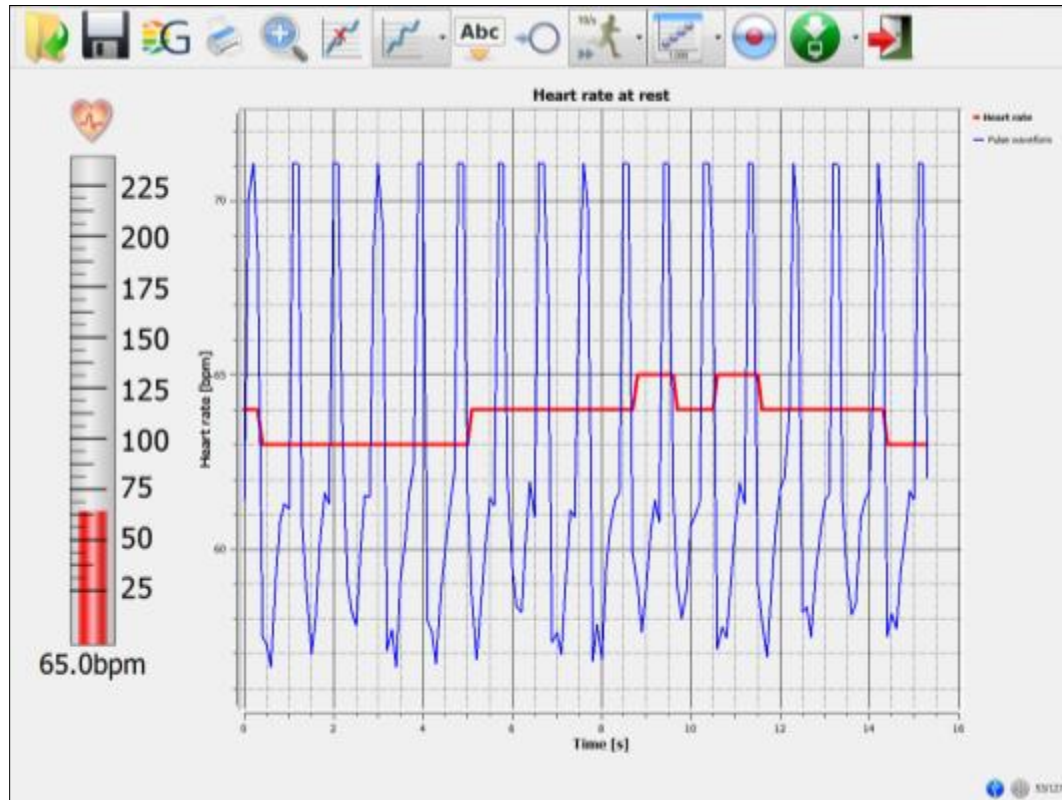
3. When we exercise our muscles need more oxygen which makes us breathe more quickly, as well our heart beating faster. Try it for yourself by performing a few minutes of exercise, such as running on the spot or doing star jumps.

4. Then stand still, connect the ear-clip to your finger or ear lobe and press the RECORD icon.   Wait for your heart beat to stabilize and then stop the recording, by pressing the STOP icon.

5. The graph on the screen should show a constant decrease in the rate of your heart beat so that eventually it is close to your rest rhythm.

6. In the example below the heart beat was decreased from 130 bpm to 72 bpm after 95 seconds.
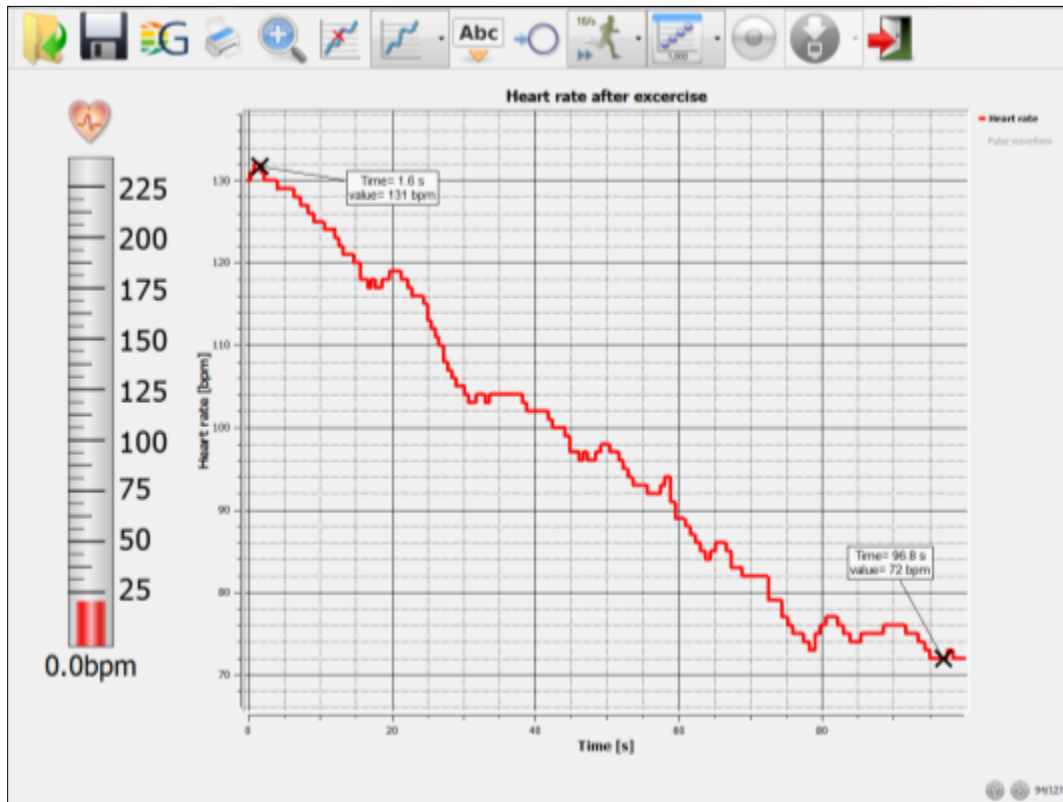
7. Click the MARKER icon. In this mode a left mouse click, near any of the graphs will place a marker on the graph with the coordinates (time and value) displayed in a small pop-up window. Place markers at the minimum and maximum heart rate levels.

8. Double click on the graph title and change the title to "Heart Rate After Exercise"

9. Save your project by clicking on the SAVE icon

Investigation and Questions

View your measurements and try to answer the questions below.

1. What was your heart rate at rest?
    - ☐ Between 90 – 120 bpm
    - ☐ Between 100 – 140 bpm
    - ☐ Between 60 – 85 bpm

2. What was your heart rate right after exercising?
    - ☐ Less than 70 bpm
    - ☐ Between 60 – 80 bpm
    - ☐ Above 120 bpm

3. How much time did it take your heart beat to decrease to below 90 bpm after exercising?
    - ☐ More than two minutes
    - ☐ Less than one minute
    - ☐ Between one to two minutes

4. If after exercising, your heart rate returned to between 60 to 80 bpm over a short period of time, it means that:
    - ☐ You are in good physical shape
    - ☐ You need to drink more water
    - ☐ Your muscles needs more oxygen

5. Athletes' heart rates at rest are:
    - ☐ Lower compared to other people of the same age
    - ☐ Higher compared to other people of the same age
    - ☐ The same as other people of the same age

6. When do you think your heart rate will be the lowest?

☐ While eating breakfast

☐ While sitting in the classroom

☐ While sleeping

Further Suggestions

1. While recording your heart beat at rest, try to relax yourself and reduce your heart beat.
2. Check your heart rate after lunch and compare it to your heart rate at rest. Is it higher, lower or the same?
3. Try to compare your heart rate measured in both your ear lobes or fingers. Is it the same?
4. Heart rate is also a good indication of when we feel frightened or nervous. Try to create an activity that demonstrates that.