

## Experiment B-44 Muscle Strength



### Objectives

- To learn about the skeletal muscles.
- To find correlations between dominant hand, gender and more to grip strength.

### Modules and Sensors

- PC + NeuLog application
- USB-200 module 
- NUL-237 Hand dynamometer logger sensor 

### Introduction

There are three types of muscle tissue in your body. The skeletal muscles are controlled voluntarily and are made of striated muscle tissue. The skeletal muscles are exquisitely tailored for force generation and movement.

Visceral muscles are controlled involuntary and are made of smooth muscle tissue. They are found within the walls of blood vessels, the urinary bladder, respiratory tract, etc. Cardiac muscle tissue is found only in the heart and has similar properties to each of the other two types.

Muscle cells contain filaments of actin and myosin which are two kinds of proteins. These protein filaments slide across each other as the muscle contracts. ATP is needed for muscle relaxation by returning the actin and myosin filaments to their relaxed position. Muscle contraction is triggered by an electrical impulse from a nerve cell that reaches a muscle cell.

A hand dynamometer is used for testing hand grip strength. It can be used to give a general index of a person's strength and compare the strength in the left and right hands. It is often used for evaluation of hand trauma or disease.



In this activity we will compare the grip strength of left and right hands, males and females and a characteristic chosen by you.

## Procedure

### Note:

The hand dynamometer logger sensor is designed for educational use only and may not be used for medical diagnose. If you suffer from a hand medical condition do not conduct this experiment.

### Sensor setup

1. Connect the USB-200 module  to the PC.
2. Check that the hand dynamometer sensor  is connected to the USB-200 module.

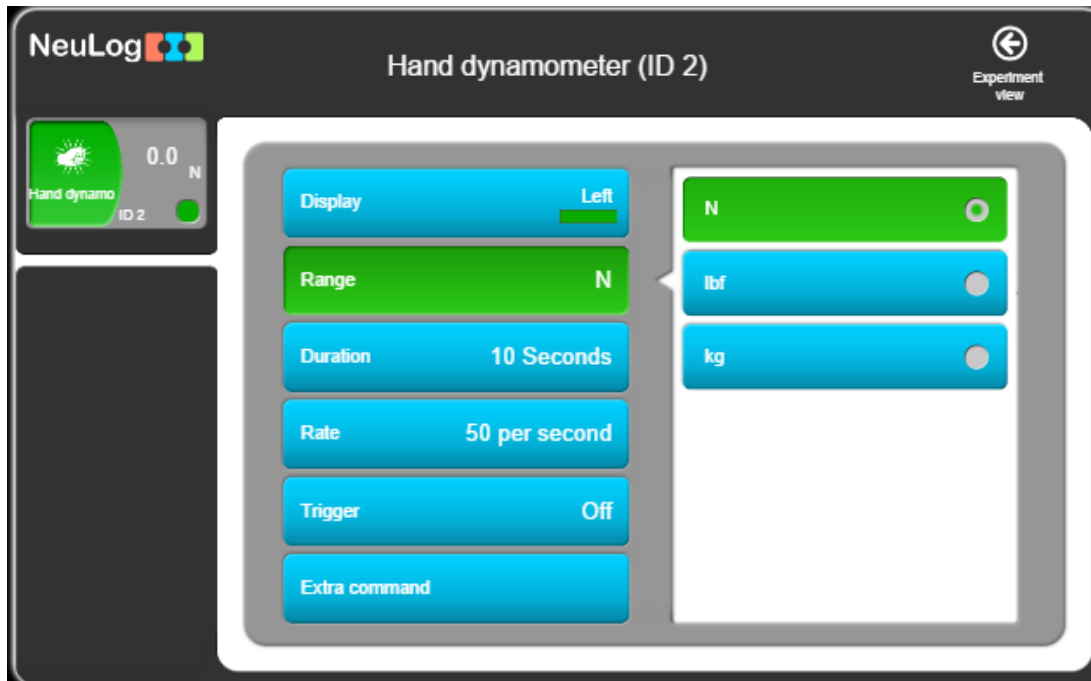
### Note:



The following application functions are explained in short. It is recommended to practice the NeuLog application functions (as described in the user manual) beforehand.

3. Run the NeuLog application and check that the hand dynamometer sensor is identified.

## Settings


4. Click on the **Sensor's Module** box.
5. Select the N button to change the sensor's mode to Newton.




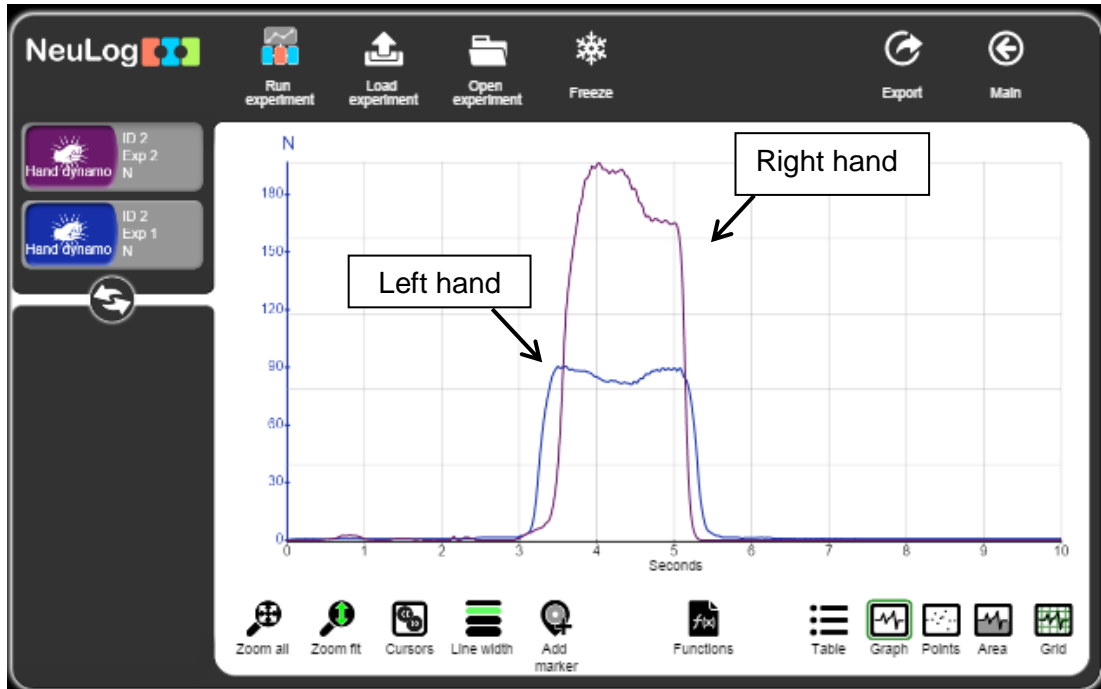
6. Hold the hand dynamometer handle with your right hand without applying any force on it.
7. Click on the Extra command button and then on the Reset button.
8. Click on the  icon to go back to the graph.
9. Click on the **Run Experiment** icon  and set the:
  - Experiment duration to 10 seconds
  - Sampling rate to 50 per second



## Testing and measurements



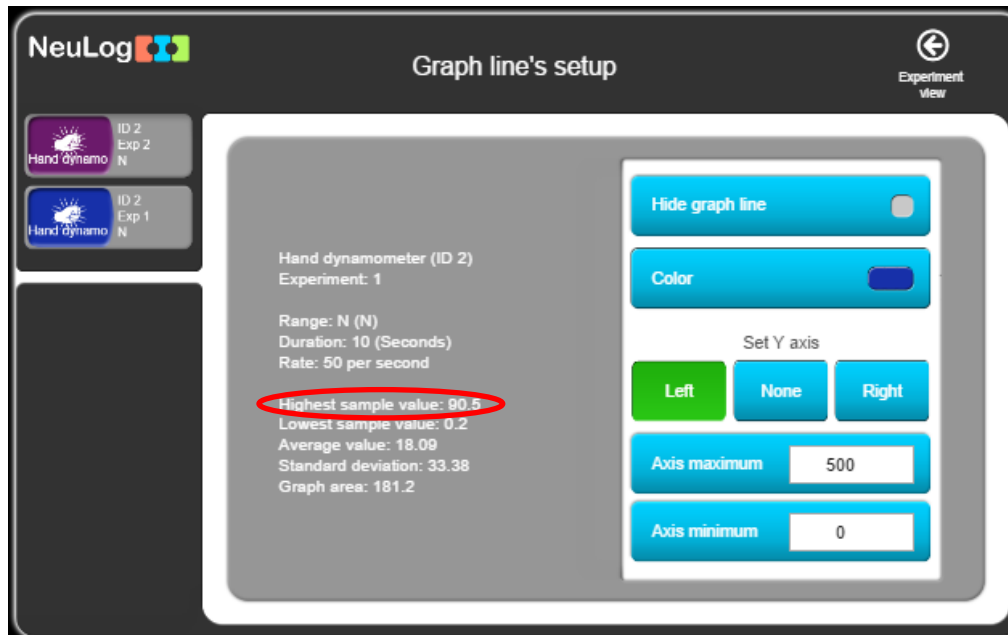
10. Click on the **Record** icon  to start the measurement.
11. Do not look at the screen during the experiment, it might affect the results.
12. After around three seconds, grip the hand dynamometer handle as hard as you can for around 3 seconds.
13. After the first measurement ends, repeat these steps for the left hand (without deleting the right hand graph).

14. At the end of the measurement, click on the **Zoom fit** icon .
15. Your graph should be similar to the following:



16. Click on the **Export** Icon  and then on the **Save value table (.CSV)** button to save your graph.
17. Click on the  icon to go back to the graph.

18. Click on the **Experiment's module box** on the left of the screen (choose the one that fits the first measurement).
19. Look at the **maximum** value.



20. Fill your results in the following table.
21. In the grey box write another characteristic that will be used for comparison between the members of your group or class. This characteristic will be chosen by your teacher or decided together by the group or class.

Student's name:	Male/ Female	Dominant hand (right/left)		Right/left hand measurement	Max. force [N]
				Right hand	
				Left hand	

22. Click on the second **Experiment's module box** on the left of the screen and fill the results in the table above.

23. Summarize all your results by filling these tables:

Right handed students' names	Right hand maximum force [N]	Left hand maximum force [N]
	Average of each parameter	

Left handed students' names	Right hand maximum force [N]	Left hand maximum force [N]
	Average of each parameter	

Female students' names	Dominant hand maximum force [N]
	Average

Male students' names	Dominant hand maximum force [N]
	Average



Fill in the blank according to your chosen characteristic:

_____ students' names	Dominant hand maximum force [N]
	Average

_____ students' names	Dominant hand maximum force [N]
	Average

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## Summary questions

1. What is the correlation between a student's dominant hand and the strength of each hand? Explain.
2. What is the correlation between a student's gender and the grip strength? Explain.
3. What characteristic did you choose? Did you find a correlation between it and the grip strength of the students? Explain.