

# fNIRS for Education



## Guided Brain and Muscle Oxygenation Labs *Functional Near Infrared Spectroscopy for Student Learning*

### fNIRS System Advantages

NIRS brings real-time imaging to the lab without the drawbacks of the functional MRI or other imaging techniques that are expensive, time-consuming, and complex. In contrast, BIOPAC's fNIRS Education System is affordable, safe (LED-based), and easy for students to use in the lab.

### What Do Students Learn with NIRS?

- Optical imaging techniques, preparing students for future careers in research, medicine, and engineering.
- How muscle oxygenation changes: during a forearm occlusion task, with gravity, and during exercise.
- How oxygenation in the prefrontal cortex changes: during cognitive tasks, with head movement, and after vasoconstriction in the skin caused by temperature.
- How to perform experiments and analyze real-life data displaying changes in oxygenated (HbO<sub>2</sub>), deoxygenated (HbR), and total Hemoglobin (HbT) levels.
- Seeing is believing—students form stronger conceptual links with readings and lecture material covering hemodynamics, cerebral energy metabolism, and neurovascular coupling mechanisms.

### Teaching Applications

Choose from one of our four lessons including nine NIRS experiments, or create your own. COBI Modern makes NIRS experimentation easy for students to start recording in under five minutes. For analysis, fNIRSoft includes tools for processing data and statistical analysis. Users can also import files in Excel and MATLAB.

Students embark on real-world research using a student-friendly approach. Biopac Student Lab's NIRS lessons are derived from scientific publications, providing students the opportunity to repeat well-known physiological phenomenon—such as in the cuff-occlusion task, and also discover trends in cognitive function among individuals.

### Hands-On Exploration of Dynamic Physiological Pathways



Pair Biopac Student Lab with fNIRS for Education to augment curriculum covering:

Neuroscience

Cognitive States

Cardiovascular Hemodynamics

Psychophysiology

Biomedical Engineering

### fNIRS Hardware, Software & Lessons for Teaching



**Correlate  
HbR, HbO<sub>2</sub> and HbT  
measurements  
with hemodynamic  
response and  
neural activity.**



**Safe & Noninvasive  
Lightweight & Comfortable  
Affordable  
Fast & Efficient Setup  
Real-time Display  
Use in Lab or in the Field**

**Ask for a demo today!**

**BIOPAC**

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# BSL Lessons for fNIRS

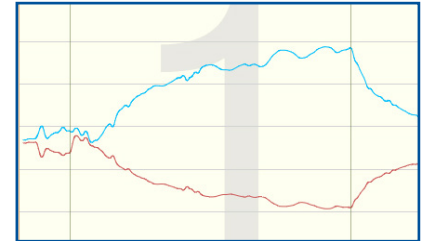
## BSL Lessons for Functional Near Infrared Spectroscopy guide students through muscle and brain oxygenation labs with easy-to-follow step-by-step instructions.

### F01 | The fNIRS System and Oxygenation Changes Measured on the Forearm

Students record fNIRS measurements to study changes in HbR and HbO<sub>2</sub> during a cuff experiment and to investigate hemodynamic changes related to muscle activity.

#### Lesson objectives:

- To explore the effect of gravity on blood flow.
- To investigate hemodynamic changes related to muscle activity.

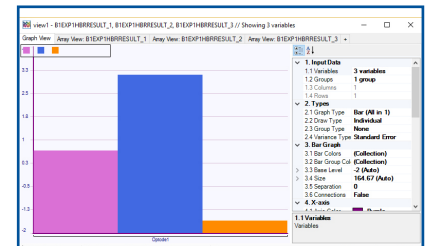


### F02 | The fNIRS System, Systemic Signals, and Artifacts

Students record fNIRS measurements from the forehead while performing various activities.

#### Lesson objectives:

- To explore the effects of head movement, blood pressure changes, and skin effects on:
  - a. raw intensity measurements
  - b. HbR signal
  - c. HbO<sub>2</sub> signal
  - d. HbT signal

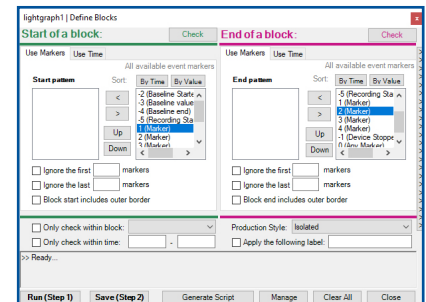


### F03 | fNIRS Measurements During Verbal Fluency Tasks

Students record fNIRS measurements from the forehead while performing a cognitive test, namely the verbal fluency test. Students will obtain changes in HbO<sub>2</sub> and HbR under different conditions within this cognitive test.

#### Lesson objectives:

- To explore oxygen consumption in the prefrontal cortex during cognitive tasks.
- To obtain oxygenation changes (HbO<sub>2</sub> and HbR) under different conditions while performing two common tests used in cognitive research:
  - a. phonemics verbal fluency (PVF) task
  - b. semantic verbal fluency (SVF) task



### F04 | fNIRS Measurements During Single and Dual Tasks

Students record fNIRS measurements from the forehead while performing a test of different cognitive loads manipulated as single and dual task conditions.

#### Lesson objectives:

- To explore oxygen consumption in the prefrontal cortex during cognitive tasks.
- To compare oxygenation levels while performing one or two cognitive tasks simultaneously.

