

biology

The BSL System can record signals from cells, organs, insects, animals and human subjects to facilitate a spectrum of application opportunities. The system has new options for pH, dissolved oxygen and calorimetry (connections & software features). A wide range of lessons covers the cardiovascular, immune, respiratory, pulmonary, metabolic, digestive and nervous systems. User-friendly recording options and analysis tools promote student inquiry and active learning. Employ new software options to develop new lessons specifically tailored to unique course material.

features

- 53+ lessons targeted for Biology
- ECG, EEG, EMG, EOG & EGG
- Respiratory & Pulmonary Function
- Temperature
- pH
- Dissolved O₂
- Gas Analysis (O₂ & CO₂)
- Oxygen uptake
- Blood Pressure
- Cardiac Output (via bioimpedance)
- Stroke Volume
- Tissue Baths
- Force
- Calorimeter Interface
- Pulse
- Autonomic Nervous System
- Nerve Conduction Velocity
- Colorimetry Tools

Suitable for inquiry-based, active learning in 2-yr. & 4-yr. programs, medical schools, and nursing programs

Biology covers a wide spectrum of applications. To complement those outlined below, see the applications detailed for Human Physiology (page 10) and Animal Physiology (page 12). As with all disciplines, the selected applications only begin to suggest what you can do with the BSL System. Contact a Biopac Student Lab Specialist to discuss your application needs.

Cardiovascular

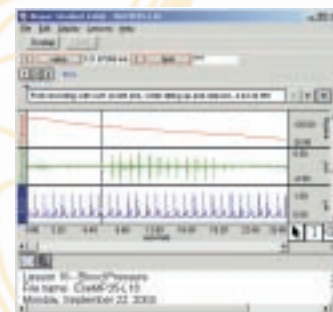
Lessons include blood pressure, ECG analysis, heart sounds, and pulse. Students can make single-, three-, six- and 12-lead ECG recordings, familiarizing themselves with Einthoven's triangle and mean electrical axis of the frontal plane. Students perform blood pressure measurements using a cuff, with stethoscope, employing Korotkoff sounds to make determinations of systolic/diastolic pressure. Students can also utilize the latest technology for continuous non-invasive BP recordings. Use the noninvasive Cardiac Output Sensor (SS31L, page 29) on human and animal subjects to record stroke volume and cardiac output. By measuring continuous mean arterial pressure simultaneous with flow (cardiac output), students can examine vascular resistance.



ECG and pulse

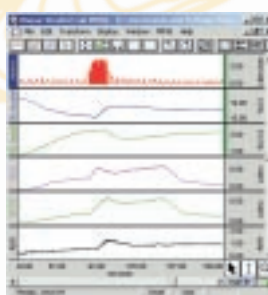
Respiratory & Pulmonary Function

Students can record the pattern of breathing as well as perform comprehensive cardiopulmonary tests. There are lessons for determining tidal volumes and lung capacities, including FEV_{1,2,3} and MVV, plus full gas analysis studies.



Blood pressure from Lesson 16

Gas Analysis



Respiratory exchange ratio

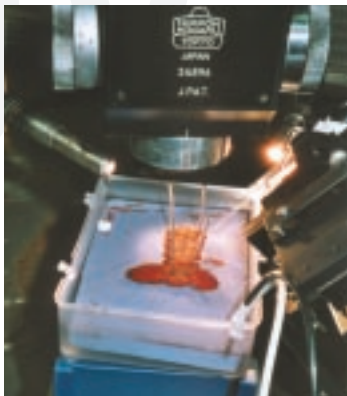
Students can use the new gas analysis system to monitor expired CO₂ and O₂ levels for detailed metabolic studies with human and animal subjects. Take measures to study ventilation and heat exchange. Use the Dissolved O₂ probe and lesson to measure the oxygen consumption of a goldfish. Chambers, facemasks, and tubing accessories provide setup options for any protocol.

Neurophysiology

Study EEG under a variety of conditions to explore relaxation and brain rhythms—the software can filter and display each rhythm separately: Alpha, Beta, Delta, and Theta. Study Alpha rhythms in the occipital lobe, reaction times, and hemispheric asymmetry. Use the system to demonstrate changes in parasympathetic and sympathetic tone. Add EOG (ocular signal) to study eye movement, saccades, tracking, angular displacement, or ocular fixations. Use the stimulator to study evoked response—auditory, visual, or somatosensory. Record reaction time and measure nerve conduction velocity. The system samples quickly enough to easily record spontaneous nerve activity from small animals and insects.

Digestive System

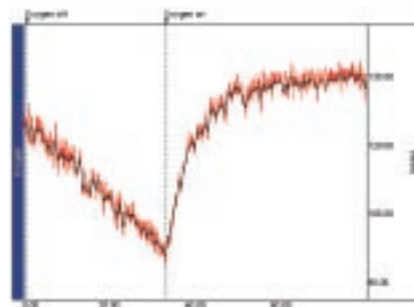
Use the system to record gastric signals in humans and animals or monitor isolated intestinal (gut) strips in a tissue bath experiment. Monitor the EGG (Electrogastrogram) before and after food digestion. Examine gastric slow wave propagation, peristaltic (slow wave) propagation, and gastrointestinal motility.



Membrane potential using crawfish and glass microelectrodes

Cellular Biology

Use the BSL hardware with suitable glass microelectrodes to demonstrate membrane potential with the frog sartorius muscle or the crawfish, and active transport using frog skin. These experiments demonstrate the principle of homeostasis and serve as a good introduction to electrophysiology recording techniques. The system will also work with the popular *Crawdadd* CD-ROM Lab Manual for Neurophysiology by Wytenbach, Johnson, and Hoy (ISBN 0-87893-947-4).



Dissolved oxygen (goldfish)

Comparative Biology

The Biopac Student Lab system is an excellent tool for comparative biology programs because students can compare data from their own bodies with data recorded from a variety of animals. The curriculum covers most of the major physiological systems, including: brain, muscle, pulmonary, cardiovascular and CNS.

biology

The following hardware suggestions will enable you to perform a wide variety of applications targeted for **biology**. Use BIOPAC lessons or easily create your own experiments with the BSL *PRO* software included with each system. Order the core package or select items à la carte.

See **BSL Hardware** (page 23) for all available transducers, electrodes and accessories.

Biology Core

BSLBIO-W (Win) or BSLBIO-M (Mac)

Basic BSL System	BSLBSC, p. 8
Airflow Filters (10/pk)	AFT1, p. 34
Airflow Mouthpieces (10/pk)	AFT2, p. 34
Airflow Nose Clips (10/pk)	AFT3, p. 34
Airflow Transducer	SS11LA, p. 27
BP Cuff Transducer	SS19L, p. 27
Calibration Syringe (600 ml)	AFT6, p. 34
Colored Paper (for BSL9)	PAPER1
Dissolved O ₂ Probe Interface	BSL-TCI16, p. 39
EDA (GSR) Lead	SS57L, p. 26

EDA (Isotonic) Electrodes (100/pk)	EL507, p. 37
Electrode Gel	GEL1, p. 36
Electronic Stethoscope Transducer	SS30L, p. 28
Force Transducer	SS12LA, p. 27
Hand Dynamometer	SS25LA, p. 27
Hand Switch	SS10L, p. 26
Headphones	OUT1, p. 26
High-Impedance Cable	BSLCBL9, p. 36
Multi-Lead ECG Cable	SS29L, p. 27
Needle Electrodes x 3	EL452, p. 38
Nerve Chamber	NERVE2, p. 38

pH Probe Interface	BSL-TCI21, p. 39
Pressure Transducer	SS13L, p. 27
Pulse Transducer	SS4LA, p. 26
Recording Nerve Cable	BSLCBL4B, p. 39
Respiratory Effort Transducer	SS5LB, p. 26
Stimulator	BSLSTM, p. 25
Stim. Electrode for humans	HSTM01, p. 28
Stim. Electrode for animals	ELSTM2, p. 38
Stimulator Nerve Cable	BSLCBL2A, p. 39
Surgical Tape	TAPE1, p. 36
Temperature Transducer	SS6L, p. 26

Perform 53 or more lessons with this core package:

Muscular

A02	Frog Gastrocnemius
A05	Visceral Smooth Muscle
A11	Resting Potential from Crawdad Manual
A12	Membrane Potential (muscle)
A15	Earthworm Smooth Muscle
BSL1	Standard & Integrated EMG
BSL2	Motor Unit Recruitment & Fatigue
H06	Finger Twitch
H07	EMG Contractions - Active Learning
H27	Facial EMG
H34	EGG Electrogastrogram
H36	Muscular Biofeedback

H08	Dive Reflex - Active Learning
H23	Signal Averaged ECG
H32	Heart Rate Variability

Pulmonary Function

A07	Dissolved O ₂ (goldfish)—with your probe
BSL8	Respiratory Cycle
BSL12	Pulmonary Function: Vol. & Capacities
BSL13	Pulmonary Flow Rates: FEV and MVV
BSL15	Aerobic Exercise Physiology

Neurophysiology

A01	Frog Pith & Prep
A03	Frog Nerve
A06	Cockroach Nerve
A08	Action Potential-Earthworm
A09	Turtle Heart
A14	CPG Hornworm
BSL3	EEG Relaxation & Brain Rhythms
BSL4	Alpha Rhythms in the Occipital Lobe
BSL9	GSR and Polygraph
BSL10	EOG Eye Movement, Saccades & Fixation
BSL11	Reaction Time
BSL14	Biofeedback: Relaxation & Arousal

H03	Nerve Conduction (ulnar nerve)
H10	EEG & Hemispheric Asymmetry
H11	Mirror Test—EDA Sensory motor learning
H12	EOG Saccades & Displacement
H13	EOG Visual Tracking vs. Imagination
H14	Ocular Fixation while reading
H15	Ocular Fixation while viewing an image
H16	Reflexes & Reaction Time - Active Learning
H24	Habituation

Biomedical Engineering: H02, H20 & H33

See page 43-45 for a description of all available lessons.

Cardiovascular

A04	Frog Heart
BSL5	Components of the ECG (Lead II)
BSL6	Leads I, II, III & Einthoven's Law
BSL7	ECG & Pulse
BSL16	Blood Pressure & Korotkoff Sounds
BSL17	Heart Sounds & Cardiac Events
H01	12-lead ECG
H04	BP Response to Straining
H05	WANT Wingate Test

Increase your lab options with...

Cardiac Output Sensor	SS31L, p. 29
Dissolved O ₂ Probe	RXPB02, p. 31
Finger Twitch Transducer	SS61L, p. 30
O ₂ & CO ₂ Analysis Module	GASSYS2-EA, p. 34
pH Probe	RXPB01, p. 31
Reflex Hammer Transducer	SS36L, p. 30