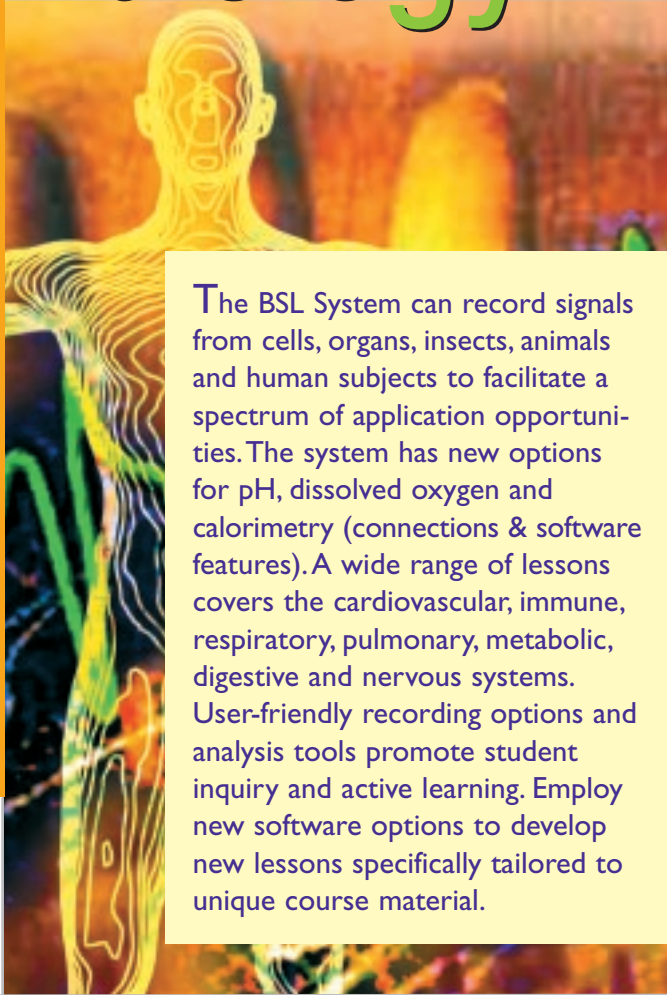# biology

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 plain. 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 noninvasive 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.
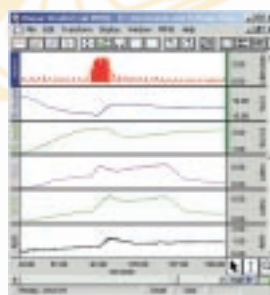

ECG and pulse

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.
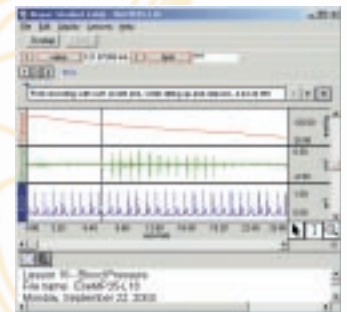
Blood pressure from Lesson 16

Gas Analysis


Respiratory exchange ratio

Students can use the new gas analysis system to monitor expired CO_2 and O_2 levels for detailed metabolic studies with human and animal subjects. Take measures to study ventilation and heat exchange. Use the Dissolved O_2 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.
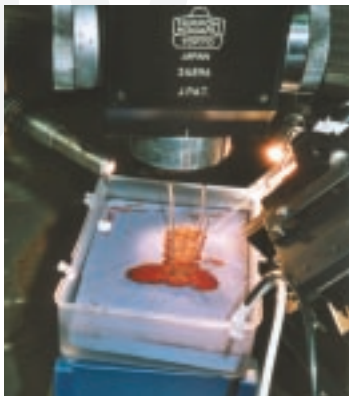
Membrane potential using crawfish and glass microelectrodes

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 *Crawdad* CD-ROM Lab Manual for Neurophysiology by Wyttenbach, Johnson, and Hoy (ISBN 0-87893-947-4).
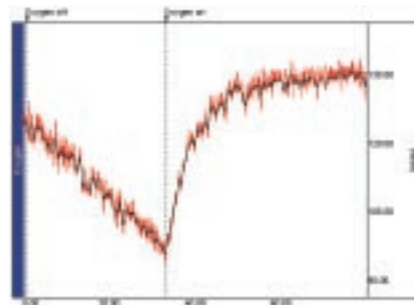
Dissolved oxygen (goldfish)

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	EDA (Isotonic) Electrodes (100/pk)	EL507, p. 37	pH Probe Interface	BSL-TCI21, p. 39
Airflow Filters (10/pk)	AFT1, p. 34	Electrode Gel	GEL1, p. 36	Pressure Transducer	SS13L, p. 27
Airflow Mouthpieces (10/pk)	AFT2, p. 34	Electronic Stethoscope Transducer	SS30L, p. 28	Pulse Transducer	SS4LA, p. 26
Airflow Nose Clips (10/pk)	AFT3, p. 34	Force Transducer	SS12LA, p. 27	Recording Nerve Cable	BSLCBL4B, p. 39
Airflow Transducer	SS11LA, p. 27	Hand Dynamometer	SS25LA, p. 27	Respiratory Effort Transducer	SS5LB, p. 26
BP Cuff Transducer	SS19L, p. 27	Hand Switch	SS10L, p. 26	Stimulator	BSLSTM, p. 25
Calibration Syringe (600 ml)	AFT6, p. 34	Headphones	OUT1, p. 26	Stim. Electrode for humans	HSTM01, p. 28
Colored Paper (for BSL9)	PAPER1	High-Impedance Cable	BSLCBL9, p. 36	Stim. Electrode for animals	ELSTM2, p. 38
Dissolved O$_2$ Probe Interface	BSL-TCI16, p. 39	Multi-Lead ECG Cable	SS29L, p. 27	Stimulator Nerve Cable	BSLCBL2A, p. 39
EDA (GSR) Lead	SS57L, p. 26	Needle Electrodes x 3	EL452, p. 38	Surgical Tape	TAPE1, p. 36
		Nerve Chamber	NERVE2, p. 38	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

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

- 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.

Increase your lab options with…

Cardiac Output Sensor	SS31L, p. 29
Dissolved O$_2$ Probe	RXPROBE02, p. 31
Finger Twitch Transducer	SS61L, p. 30
O$_2$ & CO$_2$ Analysis Module	GASSYS2-EA, p. 34
pH Probe	RXPROBE01, p. 31
Reflex Hammer Transducer	SS36L, p. 30