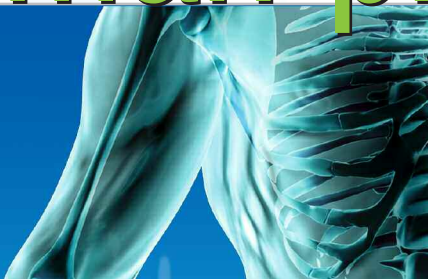# human physiology

Use the power of the BSL System to conduct the most widely studied responses in physiology labs and perform analysis online or off. Lessons target the circulatory system, respiratory system, muscular function, brain function, ANS, exercise physiology and neurophysiology. Dynamic experiments with students as subjects increase interest and retention and develop critical thinking. Basic lessons guide and prompt students—promote hypothesis-driven student inquiry with advanced options or develop user-defined lessons and research projects.

Cardiovascular

The BSL System covers a wide range of cardiovascular measures based on the heart's electrical signal. Record standard (LI, LII or LIII) or augmented (aVR, aVL or aVF) leads; add a multi-lead ECG cable to simultaneously record a pre-cordial lead. Students attach Leads I and III and the software uses Einthoven's law to display Lead II. Identify, isolate and measure

Overlapped ECG and heart sounds

components of the ECG complex under varying conditions. Use the averaging features to automate ECG analysis. View arrhythmia data obtained from the NIH PhysioBank archive. Calculate R-R interval to display heart rate variability or determine vagal tone. Use the electronic stethoscope to listen to and record heart sounds and then corre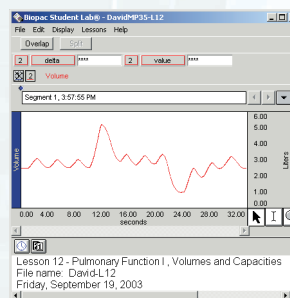late the sounds with the mechanical and electrical events of the cardiac cycle. Record cuff pressure and Korotkoff sounds to measure systolic and diastolic blood pressure. Determine pulse wave velocity. For advanced studies, use the noninvasive cardiac output sensor to record stroke volume and cardiac output.
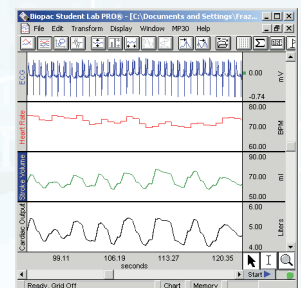
Respiratory & Pulmonary Function

The BSL provides an excellent introduction to volumes and capacities, respiratory flow rates, breathing mechanics, and ventilation. Display and/or print a clinical grid on the data for effective interpretation and training. The software guides the student in measuring FVC and in calculating FEV and MVV. The airflow transducer is handheld, lightweight, easy to clean and very easy to use. Take measures before,

Cardiac output and stroke volume

during and after exercise to study ventilation and heat exchange. The new Gas Analysis module provides online measures of CO_2 and O_2 levels for Respiratory Exchange Ratio, O_2 Consumption and Basal/Resting Metabolic Rate lessons. Non-rebreathing T-valves, air chambers, facemasks, and tubing options provide setup options to suit any protocol.

Pulmonary volume

features

- 25 lessons targeted for Human Physiology
- ECG, EEG, EMG, EOG & EGG
- Pulmonary Function $FEV_{1,2,3}$, MVV, PV Loops
- Airflow
- Blood Pressure
- Heart Sounds & Korotkoff Sounds
- Nerve Conduction
- Electrodermal Activity (GSR)
- Pulse
- Reaction Time
- Temperature
- Stimulation & Response (Somatic Reflexes)
- Gas Analysis (O_2 & CO_2)
- Colorimetry Tools
- Force & Pressure
- Cardiac Output (via bioimpedance), Stroke Volume
- Auditory, Somatosensory & Visual Evoked Response
- Angle of Movement
- Acceleration

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

Muscular

Record EMG data to investigate the properties of skeletal muscle. Record and display raw and integrated EMG signals; overlap the signals for better correlation of the data. Measure strength and repeat trials for motor unit recruitment, summation and fatigue. Use the reflex hammer transducer to study reflex response (neural control), or add the dynamometer to study handgrip strength profiles. Use the new Finger Twitch transducer for threshold, summation, tetanus and fatigue analysis. Students can listen to the muscle activity through headphones and note the increase in sound intensity as grip strength is increased through motor unit recruitment.
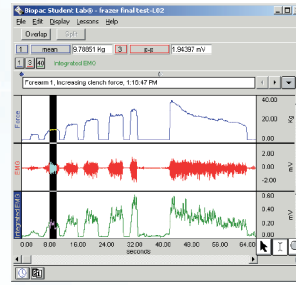
EMG and force

Nerve Conduction

Combine the human-safe stimulating electrode with the stimulator to record nerve conduction experiments. Stimulate the ulnar nerve at three different points and record nerve conduction time. Measure the distance between the stimulation and recording points and then calculate velocity.

Neurophysiology

Study EEG under a variety of conditions to explore relaxation and brain rhythms—software will filter and display each rhythm separately: Alpha, Beta, Delta, and Theta. Select from a variety of lessons to study Alpha rhythms in the occipital lobe, reaction times, and hemispheric asymmetry. Add the EOG (occipital signal) to study eye movement, saccades, tracking, angular displacement, or ocular fixations. Use the Stimulator to study evoked response—auditory, visual, or somatosensory. The new high-speed MP36 hardware allows for the recording of spontaneous nerve activity, continuously, at speeds of 100,000 samples a second. Add the SuperLab stimulus presentation package to perform psychophysiology stimulus/response protocols examining high-level brain activity. Conduct microelectrode recordings and study action potentials.

Autonomic Nervous System

Record a wide variety of ANS-related signals such as EDA/GSR, temperature, ECG, pulse, respiration, airflow, nerve conduction, continuous blood pressure, and continuous non-invasive cardiac output (using bioimpedance technique) to demonstrate changes in the parasympathetic and sympathetic nervous system activity. Use the Polygraph lesson for simultaneous heart rate, electrodermal activity (GSR), and respiration rate. See Psychophysiology & Neurophysiology on page 18 for more details.

Exercise Physiology & Biomechanics

Combine a wide range of respiratory system and pulmonary function signals with biomechanical data. Use the new Gas Analysis Module for online analysis of expired O_2

Dynamic lessons engage students

and CO_2 levels. Options are available for continuous blood pressure and cardiac output, and the system easily interfaces with force plates and other instrumentation (more than 18 ready-made connectors available). There are more than 27 specialized lessons—see page 16 for details.

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human physiology

The following hardware suggestions will enable you to perform a wide variety of applications targeted for **human physiology**. 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.

Human Physiology Core
BSLHPY-W (Win) or BSLHPY-M (Mac)

Basic BSL System	BSLBSC, p. 8
Hand Dynamometer	SS25LA, p. 27
BP Cuff Transducer	SS19LA, p. 27
Electronic Stethoscope Transducer	SS30L, p. 28
Airflow Transducer	SS11LA, p. 27
Airflow Filters (10/pk)	AFT1, p. 34
Airflow Mouthpieces (10/pk)	AFT2, p. 34
Airflow Nose Clips (10/pk)	AFT3, p. 34
Calibration Syringe (600 ml)	AFT6A, p. 34

Perform 25 or more lessons with this core package:

Muscular

BSL1	Standard & Integrated EMG
BSL2	Motor Unit Recruitment & Fatigue
H07	EMG Contractions - Active Learning
H27	Facial EMG
H34	EGG Electrogastrogram
H36	Muscular Biofeedback

Cardiovascular

BSL5	Components of the ECG (Lead II)
BSL6	Leads I, II, III & Einthoven's Law
BSL16	Blood Pressure & Korotkoff Sounds
BSL17	Heart Sounds & Cardiac Events
H08	Dive Reflex - Active Learning
H23	Signal Averaged ECG
H32	Heart Rate Variability

Pulmonary Function

BSL12	Pulmonary Function: Vol. & Capacities
BSL13	Pulmonary Flow Rates: FEV and MVV

Neurophysiology

BSL3	EEG Relaxation & Brain Rhythms
BSL4	Alpha Rhythms in the Occipital Lobe
BSL10	Eye Movement, Saccades & Fixation
H10	EEG & Hemispheric Asymmetry
H12	EOG Saccades & Displacement
H13	EOG Visual Tracking vs. Imagination
H14	Ocular Fixation while reading
H15	Ocular Fixation while viewing an image

Biomedical Engineering

H20	BME Filtering
H33	FFT Fast Fourier Transform

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

Increase your lab options with…

Stimulator	BSLSTMB, p. 25
Stim. Electrode for humans	HSTM01, p. 28
Finger Twitch Transducer	SS61L, p. 30
O_2 & CO_2 Analysis Module	GASSYS2-EA, p. 34
Dissolved O_2 Probe	RXPROBE02, p. 31
pH Probe	RXPROBE01, p. 31
Reflex Hammer Transducer	SS36L, p. 30
Multi-Lead ECG Cable	SS29L, p. 27
Cardiac Output Sensor	SS31L, p. 29
Goniometer	SS21L, p. 29
Respiratory Effort Trans.	SS5LB , p. 26
Temperature Trans.	SS6L, p. 26
Headphones	OUT1A, p. 26
EDA (GSR) Lead	SS57L, p. 26
SuperLab System	STP35W, p. 32
Transducer Accessory Pack	BSLHPY-TA, p. 42