MEDICAL EDUCATION TECHNOLOGIES, INC.

BABYSIM SOFTWARE AND USERS GUIDE©

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Designated Equipment
BabySIM

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Certificate: 1504921 **Master Contract:** 223202

Project: 1704296 **Date Issued:** 2005/09/23

Issued to: **Medical Education Technologies Inc.**

6000 Fruitville Rd
Sarasota, FL 34232
USA
Attention: Mr. Nigel Parker

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US'

C US

Issued by: Jim Saunders, P. Eng.

Authorized by: Gianluca Arcari, P.Eng.,
Product Group Manager

Gianluca Arcari

PRODUCTS

CLASS 8721 84 - ELECTRICAL EQUIPMENT FOR LABORATORY USE - Certified to US Standards

CLASS 8721 04 - LABORATORY EQUIPMENT - Electrical

PART A Adult Emergency Care Simulator, Model ECS100, cord connected, rated 115/230V, 50/60Hz, 2/1A; 12V dc, 5A.

PART B Baby-Sim Emergency Care Simulator, Model BAB-101, cord connected, rated 115/230V, 50/60Hz, 2/1A; 12V dc, 5A.

The 'C' and 'US' indicators adjacent to the CSA Mark signify that the product has been evaluated to the applicable CSA and ANSI/UL Standards, for use in Canada and the U.S., respectively. This 'US' indicator includes products eligible to bear the 'NRTL' indicator. NRTL, i.e. National Recognized Testing Laboratory, is a designation granted by the U.S. Occupational Safety and Health Administration (OSHA) to laboratories which have been recognized to perform certification to U.S. Standards.

CSA INTERNATIONAL

Certificate:	1504921	**Master Contract:**	223202
Project:	1704296	**Date Issued:**	2005/09/23

APPLICABLE REQUIREMENTS

CAN/CSA-C22.2 No. 1010.1-92 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements (Includes Amendment 1)

CAN/CSA-C22.2 No.1010.1B-97 - Amendment 2 to CAN/CSA-C22.2 No. 1010.1-92, "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements"

UL Std No. 61010A-1 - Electrical Equipment for Laboratory Use; Part 1: General Requirements

CSA INTERNATIONAL

Supplement to Certificate of Compliance

Certificate: 1504921 **Master Contract:** 223202

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
1704296	2005/09/23	Addition of Model BAB-101
1629830	2005/01/28	Alternate Construction
1504921	2004/01/16	Original Certification, Emergency Care Stimulator, Model ECS100

DECLARATION OF CONFORMITY

(In accordance with EN 45014)

We,

Medical Education Technologies Inc.
6000 Fruitville Road
Sarasota, Florida 34232 USA

declare under our sole responsibility that the product,

Type of Equipment: Human Patient Simulator Manikin
Model Number: ECS-X (AC Input)

to which this declaration relates is in conformity with the following standards or other normative documents:

EMC: EN 55011:1998 / A1:1999 Group 1 Class A
EN 61326:1997 / A1:1998
EN 61000-4-2:1995
EN 61000-4-3:2002 / A1:2002
EN 61000-4-4:1995 / A1:2001 / A2:2001
EN 61000-4-5:1995
EN 61000-4-6:1996
EN 61000-4-11:1994
EN 61000-3-2:2000
EN 61000-3-3:1995 / A1:2001

following the provision of the EMC Directive 89/336/EEC.

Sarasota, Florida 34232 USA

_____
Signature and Date

_____
Typed Name and Title

European Contact:

DECLARATION OF CONFORMITY

(In accordance with EN 45014)

We,

Medical Education Technologies Inc.
6000 Fruitville Road
Sarasota, Florida 34232 USA

declare under our sole responsibility that the product,

Type of Equipment: Human Patient Simulator Manikin
Model Number: ECS-X (DC Input)

to which this declaration relates is in conformity with the following standards or other normative documents:

EMC: EN 55011:1998 / A1:1999 Group 1 Class A
EN 61326:1997 / A1:1998
EN 61000-4-2:1995
EN 61000-4-3:2002 / A1:2002
EN 61000-4-4:1995 / A1:2001 / A2:2001
EN 61000-4-5:1995

following the provision of the EMC Directive 89/336/EEC.

Sarasota, Florida 34232 USA

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Introduction

As the worldwide leader in patient simulation technology and education, Medical Education Technologies, Inc.™ (METI®) is excited to introduce the BabySIM®. Based on the powerful METI HPS6™ software, the BabySIM incorporates highly developed infant patient physiological models that generate realistic and automatic responses to clinical interventions and drug administrations that are specific to infant patients.

METI BabySIM

What makes the BabySIM so unique is its versatility and usability. Combining intricate systems design and flexible user-oriented software achieves a high-tech, high-touch synergy that creates realistic learning experiences. The ultra-sophisticated system captures the complexities of human physiology with heart and breath sounds, palpable pulses and a myriad of other features that mirror a true and accurate representation of the human body. The intuitive design of the BabySIM and the realistic physiological models make it easy for instructors as well as learners to use the system.

The educational value of the BabySIM is summed up in the fact that critical care interventions such as infant CPR, airway management, drug administration and defibrillation, to name a few, can be applied to the simulator, better preparing healthcare professionals for critical events involving infants. With the flexibility of using preprogrammed or user-initiated scenarios, instructors can create real life drama to help hone and perfect the skills of their learners.

Contained in this User Guide

This User Guide has been designed for quick access to information on how to use and maintain your BabySIM system. Please make sure that you read and follow the **Cautions/Warnings** on the following four pages. This is for the safety of you and your learners as well as for the protection of your simulator.

Each subsequent section has been designed to keep valuable information at your fingertips. The **Clinical Features** section describes many of the physiological conditions and user interventions possible with the system. This section is useful when incorporating the use of the BabySIM into your course curriculum.

The **Equipment Overview** provides a detailed inventory of your BabySIM system components and how these components are interrelated. In addition, there is useful content pertaining to the BabySIM optional equipment in this section. It is helpful to read this section before installing the system by following the step-by-step instructions included in the **Getting Started** section.

The **Software Basics** section describes not only how to access and use your METI HPS6 software, but also how to operate in a Macintosh™ environment, useful information to those unfamiliar with a Mac.

The **Tabs** section contains detailed content on each of the specific parameters.

Using the System includes information on how the mannequin and software components work and the functionality that each supports. Step-by-step instructions on various clinical interventions are explained in this section along with how these interventions isolate critically important learning objectives. In addition, a description is provided of the METI preconfigured patient as well as detailed instructions on how to develop and save your own patients. Also included is information on the Waveform Display Monitor and the Remote Control.

We encourage you to follow the guidelines in the **Care/Maintenance** section, as this will ensure that your BabySIM is maintained to the highest standards. Warranty details as well as essential breakdown, clean up and care information are included in this section, making it a very important part of keeping your system in good working condition.

And finally, the **Index** organizes the User Guide into key words with page references to help you find what you need.

Cautions/Warnings

Please read and understand these cautions and warnings before beginning use of the BabySIM system.

USE OF THIS EQUIPMENT IN AN UNSPECIFIED MANNER, MAY IMPAIR DESIGNED PROTECTION.

Your safety is in your hands. Be sure to follow the instructions on the proper setup, breakdown and use of the BabySIM.

SHOCK HAZARD

Electrical Safety

- This product must be connected to an electrical outlet that is properly grounded. Precautions should be taken so that grounding or polarization is not defeated.
- Do not place defibrillator paddles on or adjacent to the ECG patient electrodes or the PACE patient electrodes. Contact between defibrillator paddles and the ECG/PACE electrodes may cause injury to the user and damage to the equipment.
- The METI BabySIM has been tested to work with the Physio Control Model LifePak 11 defibrillator as well as Zoll® biphasic defibrillators. The use of other defibrillators should be certified by METI prior to use.
- Always have the Power and Communications Unit (PCU) power switch turned off and unplugged when replacing fuses.
- Always use the supplied power cords. Do not substitute.
- Do not overdrive the Auxiliary Power Input circuit. Always use DC power sources rated at 12-13.5VDC.
- Operate the system from a power source with the following rating:
  - 115VAC, 50/60 hertz (cycles per second) (e.g. North America, Japan)
  - 230VAC, 50/60 hertz (cycles per second) (e.g. Europe)
- Do not spill fluids of any kind in or on any piece of BabySIM equipment.
- Compliance with CSA 22.2 No. 1010-1:1992 and UL 61010A-1 requires the BabySIM to be used indoors.
- Do not attempt to disassemble the PCU or service any of the electrical components other than the changing of fuses.

Fuse Replacement

The recommended source for replacement fuses is Littlefuse®.

- Replace fuses in the Power Entry Module with a 250V/T 2A, slow blow fuse. (Recommended replacement, Littlefuse 218 002 series.)
- Replace F1 with a 250V/T 10A, slow blow fuse. (Recommended replacement, Littlefuse 218 010 series.)
- Replace F2 with a 250V/F 5A, fast blow fuse. (Recommended replacement, Littlefuse 217 005 series.)
- Replace F3 with a 250V/T 1A, slow blow fuse. (Recommended replacement, Littlefuse 218 001 series.)
- Replace F4 with a 250V/T 4A, slow blow fuse. (Recommended replacement, Littlefuse 218 004 series.)
- Replace F5 with a 250V/T 5A, slow blow fuse. (Recommended replacement, Littlefuse 218 005 series.)

Latex Warning

METI simulators incorporate latex into their design. When performing certain maintenance procedures, the latex can become exposed. Users with latex sensitivity should take necessary precautions when handling the simulator while performing those procedures.

General Use Warnings

USE OF THIS EQUIPMENT IN AN UNSPECIFIED MANNER, MAY IMPAIR DESIGNED PROTECTION.

Power and Communications Unit (PCU)

- Do not drop, step on, or stack anything on the PCU.
- Do not operate the system in rain.
- Do not clean the PCU front panel with chemical solvents. Disconnect the PCU from the power source. Using a clean cloth, dampen with soapy water and lightly wipe. Afterwards, dry with a clean towel.

Mannequin

- Do not disassemble factory-assembled parts of the mannequin.
- Make sure that mannequin is set up on a stable, sturdy work surface to avoid collapsing and causing injury to users.
- Do not introduce foreign substances into the airway - with the exception of small amounts of approved lubricant.
- The BabySIM should be operated in ambient temperatures below 104 degrees Fahrenheit (40 degrees Celsius). Prolonged operation (> 2 hrs) in ambient temperatures greater than 104 degrees Fahrenheit (40 degrees Celsius) will result in anomalous behavior and out-of-spec performance.
- Only perform invasive procedures supported by the system as described in applicable sections of the User Guide.
- Do not pick the mannequin up by the limbs — support head and leverage weight with torso.
- Apply water to the mannequin only in accordance with the supported clinical procedures identified in this User Guide.

CO_2 Cylinders

- Follow the standard United States Department of Transportation, or applicable national agency's warnings and regulations for handling and using compressed gases.
- Air and CO_2 regulators are factory calibrated to 50 psig (345 KPa) - do not tamper with or attempt to adjust settings. All external air and CO_2 sources must be regulated to 50 psig (345 KPa).

Specifications

Size: PCU – 590 mm x 370 mm x 260 mm
Mannequin – 25 3/4 inches (65.4 cm)

Weight: PCU – 16 lbs (7 kg); Mannequin – 16 1/4 lbs (7.37 kg)

Environmental Specifications:

Operating	41°F to 104°F (5°C to 40°C)
Storage	41°F to 122°F (5°C to 50°C)

The following is for Compliance with CSA 22.2 No. 1010-1, UL 61010A-1 and EN61010-1:

Pollution Degree: 2
Installation Category II
Altitude up to 6,561 ft (2,000 M)
Humidity 92.5% up to 104°F (40°C)
Mains supply voltage fluctuations not to exceed ± 10% of nominal supply voltage.

Pneumatic Specifications:

Air	50 - 95 PSI, with peak flow rates up to 1.5 liters per minute
CO_2	Maximum flow rate = 200 ml/min

Power:

PCU and Mannequin

AC Input	AC 100 – 240VAC, 50/60Hz
Consumption	Approx. 94W
DC Input	DC 12.0 – 13.5VDC
Consumption	Approx. 72W

Instructor Workstation

AC Input	AC 100 – 240VAC, 50/60Hz
Consumption	Approx. 50W
DC Input	N/A – Internal Battery

Remote Control

AC Input	AC 100 – 240VAC, 50/60Hz
Consumption	Approx. 50W
DC Input	N/A – Internal Battery

Waveform Display Monitor

AC Input	AC 100 – 240VAC, 50/60Hz
Consumption	Approx. 28W
DC Input	N/A – Powered by the PCU

AUX Power In 12VDC 4A

BabySIM Clinical Features

The METI BabySIM represents the latest in the state-of-the-art simulation technology for educating clinicians at all levels of medical education. Sophisticated mathematical models of human physiology and pharmacology automatically determine the effect of user actions and interventions on the patient, embodied by the mannequin. In this way, patient outcomes result from clinical interventions and provide a platform for objective performance assessment.

Mannequin

The BabySIM mannequin displays the physical characteristics of a three- to six-month-old patient with interchangeable male/female genitalia. Fully operational in the supine position, the mannequin can be placed on standard operating room tables, ICU beds, on the ground or even in a vehicle (in the case of a simulated accident).

The BabySIM Mannequin

The mannequin allows for the physical assessment of various clinical signs (i.e. heart/breath sounds, palpable pulses, chest excursion, airway patency, etc.) that are dynamically coupled with the mathematical models of human physiology and pharmacology.

Physiological and Pharmacological Features

The BabySIM simulates patient reactions based on complex cardiovascular, pulmonary and pharmacological models.

Normal and Difficult Airway

The mannequin provides an anatomically realistic upper airway (oropharynx, nasopharynx and larynx), representing that of a three- to six-month-old patient.

Airway Module Features
Direct laryngoscopy as well as oral and nasal tracheal intubation can be performed.
Esophageal intubation is fully supported, in which case breath sounds, chest excursion and carbon dioxide output are absent and gastric distension occurs.
A laryngospasm actuator closes the patient's vocal cords and prevents both ventilation and intubation.
Bronchial Occlusion, when enabled, guarantees that no ventilation is possible, creating a "cannot ventilate, cannot intubate" crisis scenario.

In addition, the patient's airway supports the use of standard clinical devices such as:

- Endotracheal Tube
- Laryngeal Mask Airway
- Combitube
- Lighted Stylets

Pulmonary System

The BabySIM represents a realistic Pulmonary System, using both physical and mathematical models to achieve an extremely accurate simulation of respiration. This system is tightly integrated with the Cardiovascular System, as well as other models within the BabySIM system.

Pulmonary System Features
The simulated patient breathes spontaneously with a self-regulated rate and tidal volume sufficient to maintain a target arterial carbon dioxide partial pressure, typically 40 mmHg, which can be adjusted by the instructor. The respiratory system is capable of simulating crisis events.
The patient's lungs simulate consumption of oxygen and the production of carbon dioxide in accordance with the principles of uptake and distribution.
Alveolar and arterial gas concentrations are dynamically coupled with spontaneous or mechanical ventilation.
The lungs are realistically modeled with respect to the range of tidal volumes and functional residual capacity.
Lung and chest wall compliance are modeled with independent control of the left and right lung.
Ventilation results in the appropriate concentrations of alveolar and arterial carbon dioxide. Presence or absence of exhaled carbon dioxide can be monitored using a colormetric indicator.
Spontaneous and mechanical modes of ventilation are supported.
Symmetric and asymmetric lung ventilation is automatically supported in response to bilateral and unilateral compliance and resistance changes, proper or incorrect intubation, as well as pathophysiological states such as tension pneumothorax. This capability can be accomplished automatically without intervention of the instructor.
The mannequin's upper chest rises and falls synchronously with the inflationary state of the underlying lungs. This movement is synchronized with inspiration and expiration of spontaneous, manual and automatic ventilation of the lungs and combinations thereof. The depth of chest excursion correlates to the physiologic tidal volume displayed on the user interface.
The simulated patient generates both normal and abnormal breath sounds, bilateral and unilateral, which are appropriately synchronized with the respective phases of respiration. Breath sounds are audible over the apex of each lung with the use of a standard stethoscope.

Pulmonary System Features
In the case of esophageal intubation, breath sounds, chest excursion and carbon dioxide output are automatically absent but the stomach distends with positive pressure ventilation attempts.
Pulse oximetry is fully supported. The reported oxyhemoglobin saturation correlates correctly and dynamically with the alveolar oxygen concentration, the patient's intrapulmonary shunt fraction and the temperature and pH of the arterial blood. The saturation value can be displayed on the Instructor Workstation or on the optional Remote Control.
The pulmonary response to administered medications is automatic and dose dependent.
The physiological mathematical models continuously calculate the patient's arterial and venous blood gases and pH. This data can be displayed on the Instructor Workstation or on the optional Remote Control.
Seesaw respiratory patterns of breathing are demonstrated on the mannequin.

For further information on the Pulmonary System of the BabySIM, refer to the information regarding the **Respiratory** tab in the **Tabs** section of this document.

Cardiovascular System

Like the BabySIM's Pulmonary System, with which it is tightly integrated, the Cardiovascular System accurately simulates a wide variety of hemodynamic conditions and responses.

Cardiovascular System Features
The simulated patient generates heart sounds including a range of pathological ones that are synchronized to the QRS complex of the ECG and are audible with a standard stethoscope over the left and right upper sternal border, right lower sternal border and apex.
A 3-lead ECG is emitted from the appropriate positions on the patient's chest for display on a standard monitor. The simulator generates a normal sinus ECG, as well as a broad range of abnormalities such as sinus tachycardia, bradycardia, ventricular fibrillation and asystole.
The hemodynamic response to the arrhythmias is physiologically correct.
Palpable brachial and femoral pulses are provided and are synchronous to the ECG. A pulse deficit automatically occurs if the systolic arterial blood pressure falls below the following thresholds: Brachial: 30 mmHg Femoral: 30 mmHg
The pulse threshold set points can be adjusted by the instructor to meet specific clinical and educational requirements. The left and right brachial and femoral pulses are independently controllable by the instructor for presence and absence in the case of trauma to a specific extremity.
A standard blood pressure cuff and sphygmomanometer can be used to assess blood pressure by palpation or by auscultating Korotkoff sounds.

The invasive hemodynamic monitoring package provides the capability to measure and monitor the following:

Arterial blood pressure

Left ventricular pressure

Central venous pressure

Right arterial pressure

Right ventricular pressure

Pulmonary artery pressure

Pulmonary artery occlusion (wedge) pressure

In addition, the following responses and interventions are available with the invasive hemodyamic monitoring package:

The introduction and progressive insertion of a pulmonary artery catheter, synchronous with the appropriate waveforms, can be simulated with the results shown on the patient Waveform Display.

The patient has a baroreceptor reflex, the sensitivity of which can be controlled by the instructor.

The cardiovascular system simulates both hypovolemia and hypervolemia as well as right and/or left heart failure.

The patient's cardiovascular response to medications is automatic and dose dependent.

Metabolic System

Arterial blood gases (ABGs), including pH, $PaCO_2$ and PaO_2, and venous blood gas values ($PvCO_2$, PvO_2) are physiologically modeled within the system so that the results are made available on the Instructor Workstation and on the optional Remote Control. The data displayed corresponds accurately and dynamically to the alveolar concentration of CO_2 and O_2. Metabolic acidosis and alkalosis are simulated under instructor adjustment of the pH level, thus facilitating simulation of patients with diabetic ketoacidosis. Bowel sounds are able to be auscultated to the left and right of the umbilicus.

Genitourinary System

The mannequin is provided with both male and female genitalia. The genitourinary system provides for excretion of urine with a flow rate that is controlled by the instructor.

Neurologic System

Cardiovascular and respiratory responses to sympathetic and parasympathetic activities are modeled. In addition to the preconfigured sounds provided with the system, phonation, and patient voice are available via a wireless microphone transmitter/receiver and speaker in the head of the mannequin. An anterior fontanel is palpable that displays bulging upon activation via the software.

Pediatric Advanced Life Support (PALS) System

The unique integration of the BabySIM physical and mathematical respiratory models with its sophisticated cardiovascular models makes the BabySIM an extremely powerful tool for education in PALS, resuscitation and CPR. The following elaborates upon the capabilities of the BabySIM as they relate to such training.

- *Airway Management and Ventilation:* Alveolar and arterial gas concentrations appropriately reflect the efficacy of the employed ventilatory technique, such as bag-valve-mask, and endotracheal intubation. Administration of supplemental oxygen is entered by the instructor with automatic and appropriate patient clinical responses.

- *Chest Compression:* In accordance with PALS guidelines, effective chest compression of the patient's sternum results in artificial circulation, cardiac output, central and peripheral blood pressures, palpable pulses and CO_2 return. Pressure fluctuations are seen on invasive catheter waveforms. The presence or absence of exhaled CO_2 is directly related to chest compression effectiveness and automatically and significantly increases when cardiac resuscitation is successful.

- *Cardiac Arrhythmias:* The instructor is able to select and maintain a desired arrhythmia and control the simulated patient's response to clinical interventions.

- *Electrical Therapy:* Conventional defibrillators can be applied to the simulator. With this device, the delivered energy is quantified in real-time to trigger the appropriate patient response. The ECG can be monitored via the defibrillator contacts (paddles or pads). Also, transcutaneous pacemakers can be applied. The instructor is able to adjust the levels at which electrical capture and mechanical capture occur.

- *Pharmacological Therapy:* Common IV drugs required by the PALS algorithms are supported.

For further information on using the BabySIM in support of PALS, resuscitation and CPR education, refer to the **Using the System** section as well as the **Cardiovascular** and **Respiratory** parts of the **Tabs** section of this User Guide.

Trauma Features

The BabySIM is equipped with a number of features specifically targeted to support training for trauma care. The following provides a general overview of each feature.

- *Eye Signs:* Each eye has functional eyelids that blink and pupils that can be adjusted independently to three levels of dilation (e.g. pinpoint, normal, blown).

- *Needle Decompression of Tension Pneumothorax:* Decompression of a tension pneumothorax can be performed by inserting a needle at the mid-clavicular line of the second intercostal space on the right side of the mannequin. Proper needle placement results in rapid decompression, a rush of air exiting the proximal end of the needle, and improvement in pulmonary mechanics and gas exchange.

- *Chest Tube Placement and Management:* A chest tube can be inserted into the mid-axillary line of the fifth intercostal space on the right side of the mannequin. Using ordinary pediatric chest tube suction equipment, fluid and air can be withdrawn from the pleural space. The volume removed influences the patient's physiology to reflect improvement in pulmonary mechanics and gas exchange.

- *Secretions:* Body fluids can be excreted from the eyes, ears and mouth.

For further information on the BabySIM Trauma Features, refer to the **Using the System** section of this User Guide.

Pharmacology System

The BabySIM Pharmacology System facilitates the administration of IV drugs.

Pharmacology System Features
The pharmacology module contains pre-programmed pharmacokinetic and pharmacodynamic parameters for six intravenous medications. Atropine Epinephrine Dopamine Fentanyl Morphine Succinylcholine
The patient mannequin allows for intravenous access through a permanent access catheter located at the left femoral vein.
Bolus injections are administered utilizing standard syringes while continuous intravenous infusions can be administered utilizing a wide variety of standard infusion pumps. Both injection methods are entered from either the Instructor Workstation or optional Remote Control. Once the dosage is entered, the patient response is automatic and dependent on patient weight, physiological status, ongoing therapeutic interventions and injury/disease status.
The patient appropriately and automatically responds to incorrect medications with no user intervention necessary. Likewise, over- and under-dose response is appropriate.
The Drug Log feature of the software allows the instructor to quickly review all boluses and current drug infusions given by the learner.

For further information on the BabySIM Pharmacology System, refer to information on the **Drugs** tab in the **Tabs** section of this User Guide.

BabySIM Patients and Scenarios

The BabySIM is a model-driven, script-controlled system designed to simulate a patient's physiological condition, clinical signs, symptoms and responses to certain clinical interventions. The preconfigured Patient and multiple Scenarios provided with the HPS6 software supply the basis for an unlimited number of clinical situations.

Patient Files

In the software, each patient is represented by a patient file that defines the initial condition of the simulated patient's physiology and sets the values of the parameters and variables upon which that patient's physiological and pharmacological models are based. For example, a patient file initially sets the respiratory rate of the simulated patient's lungs — as well as other specific values. Once a patient file is loaded, the models automatically regulate the simulated patient's physiology in accordance with the type of patient defined.

The BabySIM is supplied with one preconfigured patient, Baby Ryan, representing a three- to six-month old male.

The preconfigured patient cannot be overwritten, but new patients can be created and saved, and existing patients can be modified, depending on the needs of the instructor.

Scenarios

The BabySIM system includes four preconfigured scenarios, or clinical simulations, that cover a range of events and crises:

- Increased ICP
- Infant Shock
- RSV Bronchiolitis
- Sedation Induced Apnea

By utilizing the Scenario Editor feature of the HPS6 Software, users can modify the preconfigured scenarios or create custom scenarios to meet specific educational objectives.

Each clinical simulation includes a software scenario, which is a set of simulator commands that instruct or cause the simulator to react or respond in a specific manner. Scenarios are used to determine the initial and subsequent physiological states as well as the different conditions that arise during the simulation exercise. Each simulation also includes logged documentation to support its use.

Instructors may also modify events within a given scenario in real time to increase/decrease event severity, and shorten or prolong the duration of an event at any time during a simulation exercise. Any patient can be combined with any scenario, creating a wide variety of clinical care simulations.

For instructions on modifying scenarios and creating new scenarios, refer to information on the **Scenario** tab located in the **Tabs** section of this User Guide. For instructions on modifying patients and creating new patients, refer to the **Using the System** section of this User Guide.

Patient Monitoring

The Waveform Display system allows for physiological waveforms and numeric data to be displayed in real-time without requiring a full-function patient monitor. Users can select from a number of parameters to configure the Waveform Display to address specific learning objectives.

The following patient monitoring parameters are supported:

- 3-lead ECG
- Arterial Blood Pressure
- Pulmonary Artery Pressure
- Pulmonary Capillary Wedge Pressure
- Central Venous Pressure
- Pulse Oximetry
- Body Temperature
- Arterial Temperature
- Rectal Temperature
- Axial Temperature
- Noninvasive Blood Pressure

Alarm limits with accompanying sounds can be configured for each parameter. When the pulse/heart rate is monitored, an accompanying sound is played in synchrony with the cardiac cycle. When pulse oximetry is monitored, the sound pitch dynamically correlates with the percent saturation. A 3-lead ECG is emitted from the appropriate positions on the chest of the patient mannequin for display on a standard monitor. The simulator generates a normal sinus ECG, as well as a broad range of abnormalities including sinus tachycardia, bradycardia, ventricular fibrillation and asystole.

System Controls

The BabySIM has been designed to allow the instructor to focus attention on learner actions and reactions by providing a flexible set of tools that adjust readily to the instructor's needs.

Main Application Software

The Main Application Software provides the instructor a means to control all features of the simulator. Instructors can select patient profiles and scenarios as well as control the flow of the scenarios via the user interface. Various drug, cardiovascular, respiratory, fluid and other parameters can be individually applied "on the fly" to enhance the course of a simulation exercise. A Heads-Up Display (HUD) and set of simulation log windows provides a real-time display of vital signs, blood gases, drugs administered and other events.

System Tools

Instructor Workstation: An Instructor Workstation enables the instructor to control all aspects of the simulator. Instructors can select a given patient profile or scenarios, and control the flow of a simulation exercise while monitoring patient parameters, drugs administered and other interventions. Additionally, all patient parameters can be adjusted "on the fly" to enhance the teaching points of the simulation in progress. The windowed, point and click design of the software provides an intuitive, easy to learn, and easy to use operator/instructor interface.

Remote Control (Optional): A full-function wireless Remote Control device (laptop) enables the instructor to control all aspects of the simulator from the bedside. The screens and control structure of the Remote Control look and function identically to that of the Instructor Workstation. Because the user interfaces on both the Instructor Workstation and Remote Control are identical, instructors only have to familiarize themselves with a single control interface.

Battery Power (Optional): The patient simulator equipment can be operated on battery power.

Portable Simulator: The patient simulator equipment is fully portable and easily transported in the hard-sided carrying case.

Apple Macintosh Computer Platform: Both the Instructor Workstation and the optional Remote Control operate upon the Apple Macintosh computer platform. All Macintosh computers use the OS X operating system — the operating system with a Unix foundation that supports real-time simulation with an intuitive graphical user interface.

Open System Architecture

The Main Application Software and the software for the Waveform Display both run on the Instructor Workstation. Users can take the Instructor Workstation to another location to develop simulations independent of the patient mannequin.

Equipment Overview

The METI BabySIM has been designed to be used in any learning environment. The BabySIM's standard features are easily integrated into a laboratory setting where the BabySIM can be operated using controlled central air/gas supply sources and regular AC power. However, because the portability of the BabySIM allows for its use in offsite locations, an optional Air Compressor and an optional Auxiliary Power Supply are available for those areas that do not have a central air/gas supply or an electrical power source.

Components Inventory

The BabySIM comes with all the necessary equipment for establishing an educational simulation center for the study of infant care.

	Standard Equipment
	BabySIM Mannequin and Umbilical Assembly
	Mannequin Carrying Case
	PCU with Wireless Receiver
	Instructor Workstation (Laptop) and Ethernet Cable
	Waveform Display Monitor, Video Cable and Adapter
	Replacement Parts Kit
	Wireless Microphone

Detailed descriptions of this equipment can be found in the section **BabySIM Standard Equipment**, beginning on page 2.3.

IMPORTANT: METI packaging is specially designed to protect METI products during shipping. It is important that you KEEP all of your original SHIPPING MATERIALS, including the boxes. All warranty and repair items must be return shipped to METI in the original packaging.

Optional equipment is available to accommodate special customer requirements. For example, options like auxiliary power, air compressors, and a wireless remote enable instructors to create real-life scenarios at authentic locations.

	Optional Equipment
	Auxiliary Power Supply
	Air Compressors (In-Room and Out-of-Room)
	Wireless Remote Kit (Laptop)
	Shoulder Bag and Sleeves
	Computer Stand
	Gas Accessory Kit
	CO_2 Regulator, Hose, and Tank Wrench

Detailed descriptions of this equipment can be found in the section **Optional Equipment for the BabySIM**, beginning on page 2.11.

As you would with any shipment, crosscheck this inventory with your METI packing invoice to verify that all components have been received.

Contact a METI Sales Representative at 866-462-7920 if there are any questions or if optional equipment is needed.

BabySIM Standard Equipment

The design of the BabySIM system allows students to focus on the patient mannequin while giving instructors the ability to create an endless number of possible clinical situations.

Full-Body Infant Mannequin and Umbilical Assembly

All patient assessments and clinical interventions are played out on the BabySIM mannequin, which represents a three- to six-month-old infant. At 25 3/4" (65.4 cm) in height and weighing 16 1/4 pounds (7.37 kg) , the mannequin is fully operational in the supine position and can be placed on any flat surface such as a gurney, an emergency room operating table, the ground, or even in a vehicle. The mannequin offers features like breath and heart sounds, palpable pulses, baby sounds, genitourinary features and airway management features.

Full Body Infant Mannequin

A bundled system of hoses known as the fluidic/pneumatic pigtail and an electrical cable called the electrical pigtail are attached to the mannequin in the perineum area. Both pigtails attach to the Umbilical Assembly.

The Umbilical Assembly holds a bundle of color-coded hoses and an electrical cable. The electrical cable, which provides power and transmits information from the Instructor Workstation, has a specialized fitting that connects to the PCU's 12-volt DC power source. The bundle of colored hoses connects to the receptacle beneath the electrical cable on the PCU. These hoses provide for a variety a functions:

Red	IV Source (currently unused)
Blue	IV Drain
White	Trauma Source
Orange	GU Source

Hard-Sided Mannequin Carrying Case

The Hard-Sided Mannequin Carrying Case is designed to keep the mannequin secure during transport and storage.

Inside the case are foam inserts that hold the mannequin in place and enough extra room for storing clinical accessories.

With heavy-duty wheels and durable handles, the case can be rolled or carried easily between locations.

Hard-Sided Mannequin Carrying Case

Replacement Parts Kit

A Replacement Parts Kit is included with the BabySIM. Details on how to use the replacement parts can be found in the **Using the System** section of this User Guide.

The Replacement Parts Kit includes:

- Manual Blood Pressure Adapter
- PCU Fuse Kit
- Silicone Lubricant Spray
- Red Tape
- PCU Hose Fittings (2)
- Cable Clamps (2)
- Secretion Adapters (3)
- Interchangeable Female Genitalia
- (The mannequin is shipped with the male genitalia
- attached.)
- Hard-Sided
- Mannequin Carrying Case

Power and Communications Unit (PCU)

The PCU is the hub of communication and power for the BabySIM system. This unit is about 24" tall x 15" wide x 10" deep (610 mm tall x 380 mm wide x 254 mm deep) and weighs about 10 pounds (5 kg). Conveniently contained in a rolling, hard-sided case, the PCU is the most central of all the BabySIM system components. Inside the PCU is a DC power supply and the Wireless Ethernet Switch.

BabySIM PCU

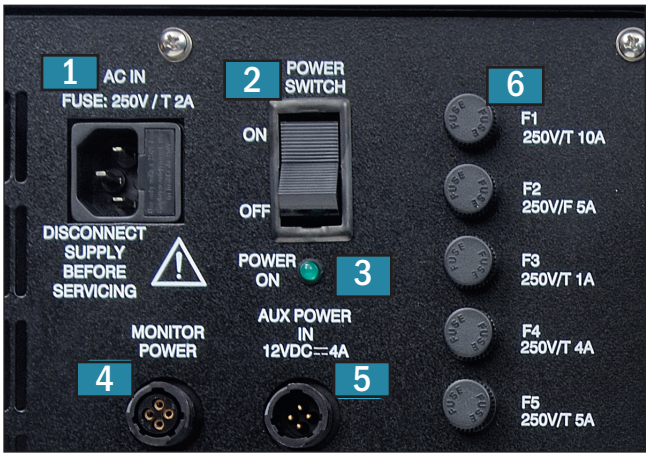
When in operation, the PCU should be placed horizontally so that the cover opens upward as shown in the picture to the right.

Located beneath the cover on the PCU Interface Panel is the Wireless Receiver, the power switch and a number of labeled ports.

PCU Interface Panel

PCU Power Ports, Fuses and Switch

Located in the upper left of the PCU are the electrical controls, the source of the power for the PCU as well as the monitor.



PCU Power Ports, Fuses, and Switch

1 In a standard laboratory configuration (using AC Power), the power cord is plugged into the **AC IN** port. This should be done prior to plugging the cord into the power source, which should be a surge-protected outlet to protect the integrity of the electrical system and reduce the chance of blowing fuses.

NOTE: Beside the **AC IN** port is small fuse panel labeled **Fuse: 250V/T2A**. Before replacing a burnt fuse, refer to the **Cautions/Warnings** found in the **Introduction** section of this User Guide.

2 The **POWER SWITCH** is used to turn the PCU **ON** and **OFF**, whether running on standard AC current or utilizing a 12-volt DC power supply.

3 A green indicator light labeled **POWER ON** illuminates when the PCU is running.

4 When the PCU is running off 12-volt DC power, the **MONITOR POWER** port supplies power to the Waveform Display Monitor using the supplied adapter cord.

5 The **AUX POWER IN 12VDC-4A** port allows the BabySIM system to be run from a 12-volt DC power source such as the optional Auxiliary Power Supply.

6 The five fuses housed in the ports labeled **F1** through **F5** are identified by their voltage and amperage. To change a fuse, open the port cap with a flathead screwdriver so that the burnt fuse pops out. Be sure to choose the correct fuse from the Spare Fuse Kit when selecting a replacement. The new fuse is secured by replacing the cap and tightening it with a flathead screwdriver.

NOTE: Before replacing a burnt fuse, refer to the **Cautions/Warnings** found in the **Introduction** section of this User Guide.

Umbilical Ports

The two large circular fittings labeled **UMBILICAL** are used to connect the mannequin via the umbilical to the PCU.

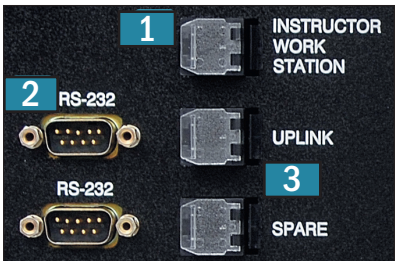
Umbilical Ports

1 The upper circular port is the receptacle for the umbilical's electrical cable and has a notched fitting where the cable connects and locks into place. This connection establishes the communication of electrical input/output and computer signals to the mannequin.

2 The lower circular port is the receptacle for the pneumatic/fluidic portion of the umbilical and has a white plastic fitting into which the five hoses wrapped in the umbilical are secured. The pneumatic/fluidic assembly allows gases (CO_2 and air) to flow to the PCU and back to the mannequin.

Instructor Workstation Uplink and Expansion Ports

There are three Ethernet and two RS-232 ports on the PCU. At present, only the **INSTRUCTOR WORKSTATION** port is used. The other ports are available for future product enhancements.



Instructor Workstation Uplink and Expansion Ports

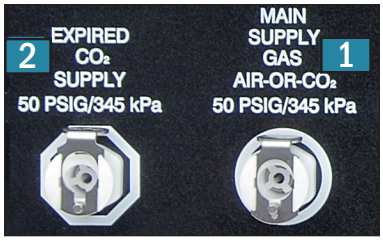
1 The **INSTRUCTOR WORKSTATION** port connects the Instructor Workstation (the laptop) to the PCU through an Ethernet cable.

A Wireless Ethernet Switch inside the PCU directs signals from the Instructor Workstation to the patient mannequin. The switch is maintenance-free and requires no usage or care instructions.

2 The two **RS-232 ports** and the **UPLINK** and **SPARE** Ethernet ports are available as 3 expansion ports for future product development. They are currently not utilized.

Gas Supply Connections

At the bottom-left of the PCU Interface Panel are two ports labeled **MAIN SUPPLY GAS AIR-OR-CO_2** and **EXPIRED CO_2 SUPPLY** along with their pressure specifications: **50 PSIG/345 kPa**.



Gas Supply Connections

1 The **MAIN SUPPLY GAS AIR-OR-CO_2** port is used to connect compressed air or gas via a hose to the PCU. With this connection, various "life signs" can be displayed on the mannequin, such as breathing and pulses.

2 For the mannequin to exhale CO_2, a CO_2 source must be connected to the **EXPIRED CO_2 SUPPLY** port.

An optional Gas Accessory Kit is available for connecting CO_2 to the PCU.

Audio Jack and Wireless Channel Set

The small jack labeled **AUDIO OUT** allows you to connect the simulator's audio outputs directly into an available audio/visual system to amplify the patient's sounds for a larger audience.

Audio Jack

Currently, only Heart Sounds are reproduced and all sounds are reproduced monaurally. At this time, the Waveform Display Monitor does not utilize the audio feature of the PCU.

The Wireless Receiver works in tandem with the Wireless Remote Microphone to provide the instructor with a means of verbal communication through the mannequin.

Wireless Channel Set

The dual antennas of the microphone pull out to increase range, and the receiver has a channel selection and volume control feature to produce high quality sound. The receiver is powered from a power supply inside the PCU.

Computer Components

The BabySIM computer system is comprised of an Instructor Workstation and a Waveform Display Monitor.

Instructor Workstation

The Instructor Workstation is a laptop computer that utilizes the METI HPS6 software to operate as the main simulation control center.

Instructor Workstation

The computer runs the underlying mathematical models that generate the physiological data that is realized on the mannequin. Instructors control the simulator session from the Workstation by selecting patient profiles and scenarios that meet the objectives of the training module. A standard Ethernet cable attaches the computer to the PCU.

Waveform Display Monitor

To view the patient physiological changes, a Waveform Display Monitor is provided with the BabySIM. This monitor plugs directly into the Instructor Workstation using a video cable.

Waveform Display Monitor

The Waveform Display application is launched from the Instructor Workstation and appears automatically on the monitor. Using the Waveform Display monitor and software, instructors and learners can monitor the progress of various interventions and protocols on the patient.

IMPORTANT: All METI computer components are preconfigured for use with the BabySIM system. There are no software installation or configuration steps required. Only approved METI applications should be installed or run on the BabySIM computer system.

Optional Equipment for the BabySIM

Additional components enable the BabySIM system to be customized to fit the specific needs of a wide variety of education environments.

Wireless Remote Control

METI offers an optional Wireless Remote Control laptop to be used when the use of a power cord is restrictive.

Preconfigured with the same software as the Instructor Workstation, the Wireless Remote Control connects to the PCU using a wireless signal.

To order this option, refer to product **#HPS-501.**

Computer Stand

METI offers an optional computer stand that is designed to support the Instructor Workstation, the Waveform Display Monitor and the optional Remote Control unit.

Each stand is made of sturdy metal and weighs less than 2 pounds (less than 1 kg).

To order this option, refer to product **#STN-001.**

Wireless Remote Control and Computer Stand

Shoulder Bag and Sleeves

The optional Shoulder Bag with padded sleeves can be used to carry computer components to another location or to store the system when it is not in use.

Shoulder Bag and Sleeves

The shoulder bag is soft-sided and large enough to hold all of the available computer components as well as the various power supply and cables.

To order this option, refer to product **#CAS-001.**

Auxiliary Power Supply

METI makes available two different Auxiliary Power Supply options for running the BabySIM system in a remote location. Both components include a 12-volt DC power source and a 25' (7.5 meter) cable with the appropriate fittings to connect to the PCU Interface Panel in the port labeled **AUX IN 12VDC**.

Auxiliary Power Supply Kit #APS-001

Auxiliary Power Supply Kit #APS-002

The Auxiliary Power Supply should run the system for approximately three hours. Both of the METI options are rechargeable using a local AC power source.

To order one of these option, refer to product **#APS-001** and **#ASP-002**.

Any auxiliary power supply used with the BabySIM must agree with the following specifications:

AC Input:	AC 100-240VAC, 50/60 Hz
Consumption:	Approx. 94W
DC Input:	DC 12.0 — 13.5VDC
Consumption:	Approx. 72W

Air Compressor

For educational environments with power but no central air/gas supply, two air compressors are available as options. An air compressor designed for quiet operation is available for in-room use, and an alternative air compressor is available for situations where the compressor resides in a location, such as a storage room, set apart from the simulator.

Out-of-Room Air Compressor
#AIR-002

Quiet In-Room Air Compressor
#AIR-003

Both Air Compressors are AC powered and include a regulator and an air hose with the appropriate connector fitting.

To order this option, refer to product **#AIR-002** and **#AIR-003**.

Gas Accessory Kit

The Gas Accessory Kit includes two complete assemblies for connecting a central supply of compressed air and CO_2 to the PCU.

Gas Accessory Kit

Both assemblies have color-coded hoses (yellow for air and gray for CO_2) which are attached to independent adjustable pressure regulators. These regulators are used to ensure the pressure supplied to the system is 50 psig/345 kPa. The appropriate PCU fittings are attached to the other end of the hoses for easy configuration.

To order this option, refer to product **#GAS-005.**

CO_2 Regulator Assembly

The CO_2 regulator attaches readily to a small CO_2 canister.

Attaching the CO_2 Regulator

CO_2 Regulator Connected

A wrench is supplied with the regulator to open the CO_2 valve on the canister. The regulator is factory set for 50 psig/ 345 kPa.

Please refer to the **Cautions/Warnings** located in the **Introduction** section of this User Guide for safety instructions.

Follow local warnings for the handling and use of compressed gas.

Use extreme caution when fastening the regulator into place.

Keep the CO_2 canister in an upright position when attached to the regulator. Failure to do so could cause damage to the CO_2 regulator.

Getting Started

The BabySIM system is comprised of four basic components:

The Mannequin

The PCU

The Instructor Workstation

The Waveform Display Monitor

Basic setup requires connecting these four components as well as the air/gas and electrical supplies. Setting up the BabySIM system the first time should take approximately 30 minutes, but setup time is reduced with practice.

Setting Up

The table below outlines the steps required for configuring the BabySIM system.

	Setup Steps
1	Prepare the Work Area
2	Attach Umbilical Assembly to Mannequin
3	Position the PCU
4	Connect the Umbilical Assembly to the PCU
5	Connect Air/Gas Source to the PCU
6	Configure the Instructor Workstation
7	Configure the Waveform Display Monitor
8	Connect Instructor Workstation to Waveform Display Monitor
9	Establish Ethernet Connection
10	Power On the PCU
11	Power On the Waveform Display Monitor
12	Power On the Instructor Workstation
Optional	Power On the Wireless Remote Control
13	Set Up the Wireless Remote Microphone

Further details for each of these steps are included in the pages that follow.

Before Beginning

Proper operation of the BabySIM requires correct configuration. Before setting up the system, keep in mind these basic guidelines:

Understand the **Cautions/Warnings** information located in the **Introduction** section of this User Guide.

Follow the sequence of steps carefully:

Complete all steps in order,

Do not power on any components until instructed in the text, and

Do not attach air/gas supplies until instructed in the text.

KEEP all original shipping materials, including the BOXES - warranty and repair items must be return shipped to METI in their original packaging.

If unpacking the BabySIM system for the first time, careful use of a box cutter protects both the packaging and the product.

Because shipping materials should be stored and retained, be sure that all protective packing materials and unused ancillary computer parts are secured as well.

A Setup Map and Quick Start Chart cover these same steps in abbreviated fashion and are included with this User Guide.

Step 1: Prepare the Work Area

Select a work area with enough room for the equipment as well as necessary hoses and cables, providing ample space for easy access to the mannequin. As least a 10' x 12' (3 meter x 4 meter) work area is recommended for movement and positioning of components around the mannequin.

The BabySIM Mannequin and Case

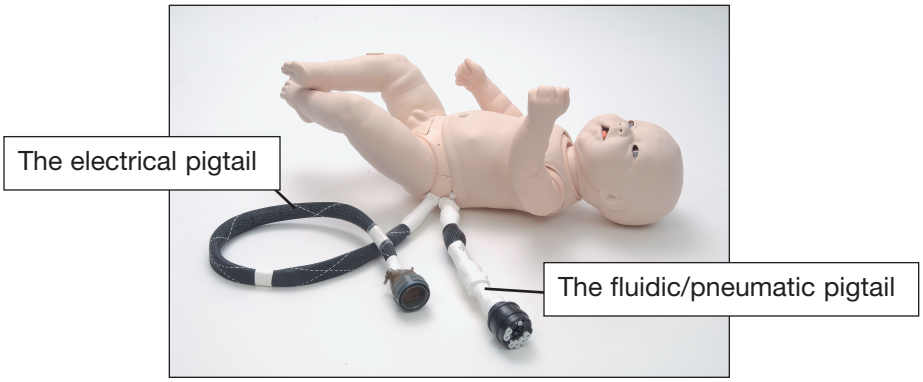
Place the mannequin in the supine position on the work surface (e.g. gurney, table, ground, etc.) and prepare all other components.

In a lab environment, make sure that a multi-plug AC power outlet exists within the workspace. This outlet should be surge-protected. The PCU, Instructor Workstation and the Waveform Display all require power in this configuration.

In a remote setting, the OPTIONAL Wireless Remote Control, Air Compressor, and Auxiliary Power Supply may take the place of the Instructor Workstation, laboratory gas and power supplies.

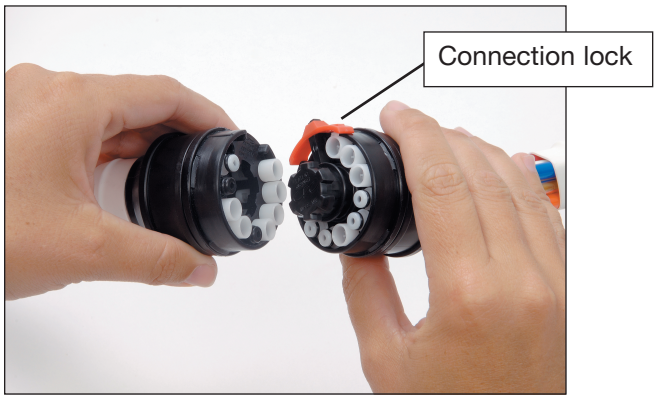
Step 2: Attach Umbilical Assembly to Mannequin

The fluidic/pneumatic pigtail, a bundled system of hoses, and the electrical pigtail extend from the left side of the baby mannequin. Both pigtails attach to the Umbilical Assembly.



The Mannequin with Pigtails

Attach the fluidic/pneumatic pigtail fitting to the Umbilical Assembly using the end with the rounded hose attachment, called the pneumatic coupler.

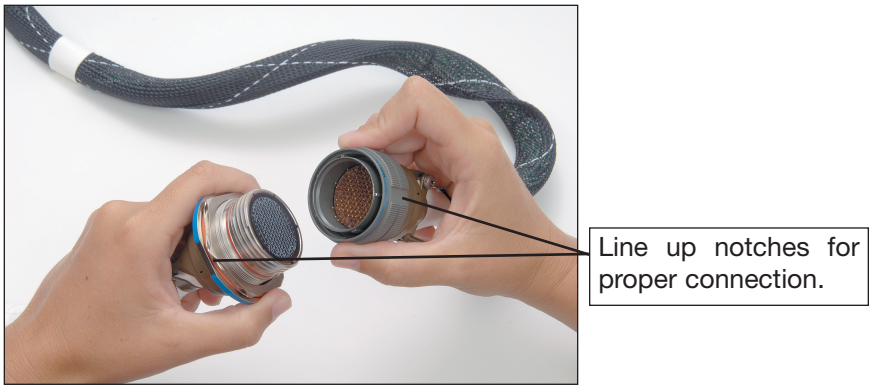


Fluidic/Pneumatic Connection to Umbilical

Once the two assemblies are fit into place, the tab lock secures them into position.

There are four unattached hoses coming from the Umbilical Assembly: red (IV Source, currently not used), blue (IV Drain), orange (GU Source) and white (Trauma Source). These hoses are used in various clinical procedures and are discussed with those procedures later in this User Guide.

Connect the electrical cable from the Umbilical Assembly to the fitting on the electrical pigtail. Use the small notches on the inside edge of the pigtail as a guide when sliding the fittings together.



Electrical Connection to Umbilical

Once the two ends are connected, rotate the fitting on the outside portion of the connection clockwise until tight.

Tighten Fitting

Step 3: Position the PCU

Position the PCU on the left side of the mannequin (where the pigtails and Umbilical Assembly are located). Allow for enough space for movement around the mannequin without jeopardizing the 12 foot Umbilical Assembly that extends from the mannequin to the PCU.

Place the PCU case flat on the floor (like an open suitcase) and open the door to expose the PCU Interface Panel.

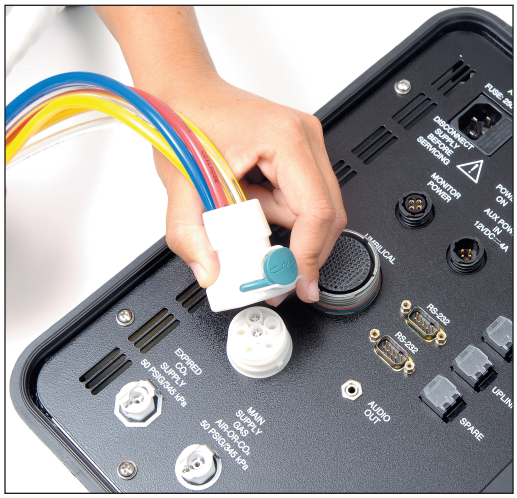
The PCU in Position

Do NOT plug in the PCU at this time.

Leave the power switch in the OFF position.

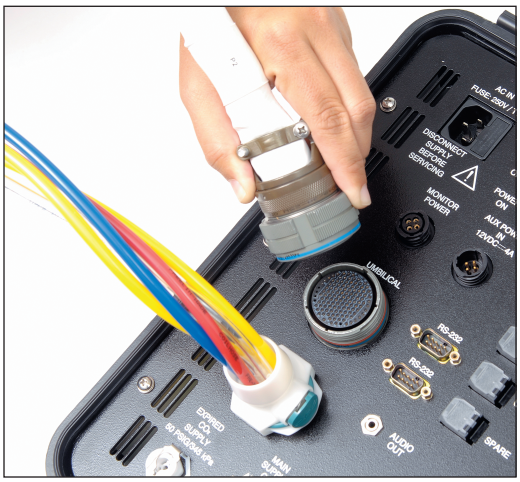
Step 4: Connect the Umbilical Assembly to the PCU

Attach the fluidic/pneumatic coupler to the lower UMBILICAL port on the PCU.



Fluidic/Pneumatic Coupler Connected to PCU

Next, attach the electrical portion of the cable to the upper UMBILICAL port.



Electrical Cable Connected to PCU

Line up the small tabs and notches on the fittings to slide them together before turning and tightening the connection.

Step 5: Connect Air and/or Gas Hose(s) to PCU

Connect either a compressed air source hose or a CO_2 supply hose to the port labeled MAIN SUPPLY GAS AIR-OR-CO_2. This connection provides either the air or carbon dioxide used to create various mannequin "life signs."

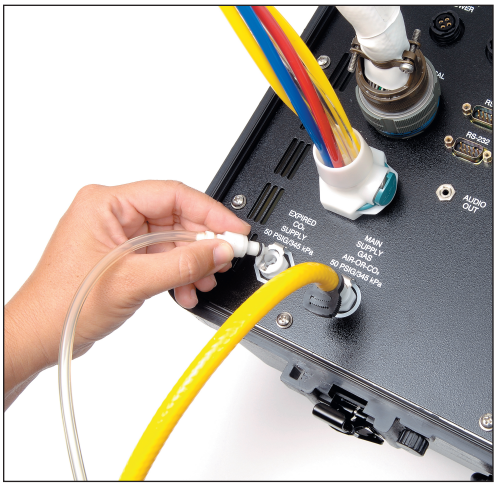
Connecting Air or CO_2 to PCU

Compressed air and gas sources must be pressurized to 50 psig/345kPa.

In remote settings, or in locations without a central air supply, an OPTIONAL Air Compressor is connected to the PCU at the MAIN SUPPLY GAS AIR-OR-CO_2 port.

The OPTIONAL Gas Accessory Kit is available for locations with larger compressed gas cylinders.

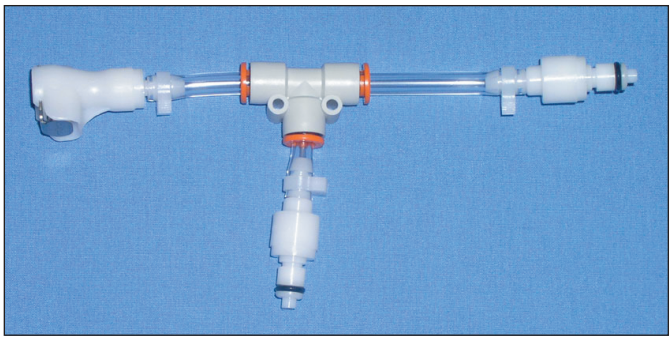
For the mannequin to expire CO_2, attach a CO_2 source hose to the EXPIRED CO_2 SUPPLY port.



Connecting Expired CO_2 to PCU

CO_2 sources must be pressurized to 50 psig/345 kPa.

When using a portable CO_2 supply, the CO_2 Adapter connects with the CO_2 supply and the PCU to operate the mannequin on CO_2 as well as to expire CO_2.

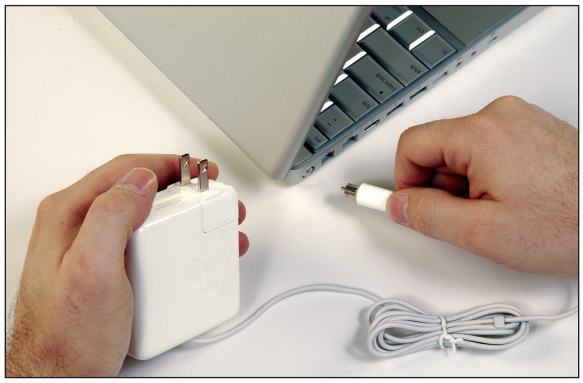


CO_2 Adapter

The branches of the Y-shaped adapter are connected to the MAIN SUPPLY GAS AIR-OR-CO_2 and the EXPIRED CO_2 SUPPLY ports and the remaining connection is made to the portable CO_2 supply.

Step 6: Configure the Instructor Workstation

Place the Instructor Workstation (laptop) at the location (e.g. desk, table) where it will be used. Plug the AC power adapter into the power port on the laptop.



Plug the AC Adapter into the Laptop

Plug the other end of the AC adapter into a surge-protected AC power outlet.

For remote use, the laptop computer has battery power. Check to be sure that the battery is fully charged (up to 6 hours of battery life) before relying on the laptop without an AC power source.

An OPTIONAL Computer Stand is available to support the Instructor Workstation.

Step 7: Configure the Waveform Display Monitor

Place the Waveform Display Monitor to the right of the Instructor Workstation in a location easily visible for those examining the mannequin. Plug the AC power cable into the port on the back of the monitor.

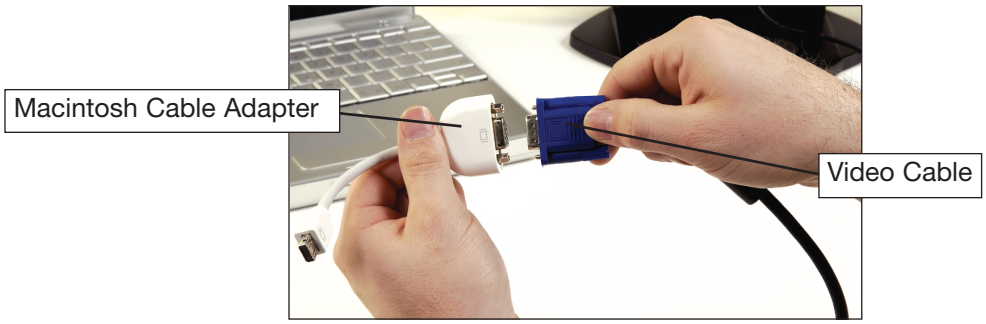
Plug the AC Cable into the Waveform Display Monitor

Plug the cable into a surge-protected AC power outlet.

The Waveform Display Monitor can also be powered through the PCU by plugging the cable labeled MONITOR POWER (included with the monitor) into the Waveform Display Monitor and connecting this cable to the PCU port labeled MONITOR POWER. This configuration is also employed when using the OPTIONAL Auxiliary Power Supply in a remote setting.

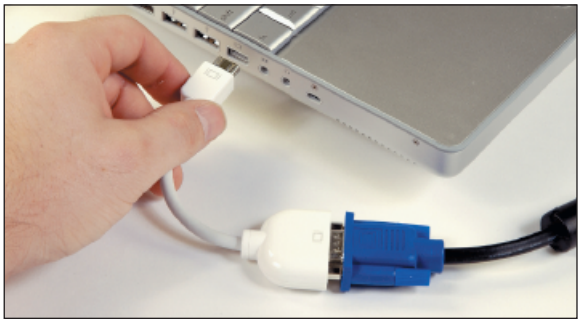
Step 8: Connect Instructor Workstation to Waveform Display Monitor

Connect the Macintosh cable adapter to the video cable. Tighten the thumbscrews on the video cable to secure the connection.



Connect Video Cable and Apple Cable Adapter

Plug the remaining end of the Macintosh cable adapter (with the |□| icon) into the port on the Instructor Workstation with the same icon.



Plug the Cable Adapter into the Workstation

Plug the remaining end of the video cable into the back of the Waveform Display Monitor and tighten the thumbscrews to secure the connection.

Connect the Video Cable to the Monitor

The system is now configured to display the Waveform Display software on the external monitor.

Waveform Display Monitors have external speakers that can be connected to the Instructor Workstation so that the sounds produced come through the monitor's speakers instead of those on the Instructor Workstation.

Monitors also come with an audio cable and an audio extension cable. The extension cable is used when required by the distance between the Workstation and Display Monitor.

Plug one end of the audio cable into the speaker port (not the headphone port) at the back of the monitor.

Connect the Audio Cable to the Monitor

Plug the other end of the audio cable into the analog external speaker port identified by the Audio Input Icon on the Instructor Workstation.

The Audio Input Icon

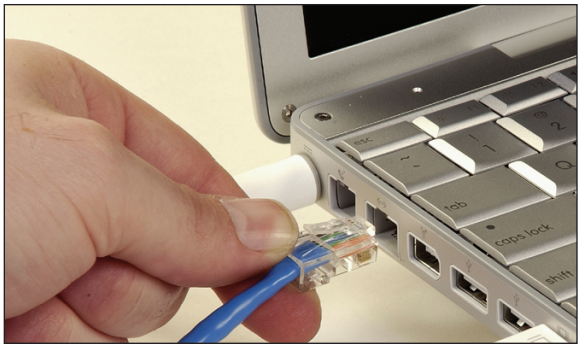
Connect the Audio Cable to the Workstation

The Waveform Display Monitor is now completely configured with the Instructor Workstation.

Instructor Workstation and Waveform Display Monitor

Step 9: Establish Ethernet Cable Connection

Plug one end of the Ethernet cable into the Instructor Workstation.



Connect the Ethernet Cable to the Workstation

Plug the other end of the Ethernet cable into the port on the PCU labeled INSTRUCTOR WORKSTATION.

Connect the Ethernet Cable to the PCU

Step 10: Power On the PCU

In standard laboratory settings, plug the power cord into the PCU port labeled AC IN.

Connect Power Cord to PCU

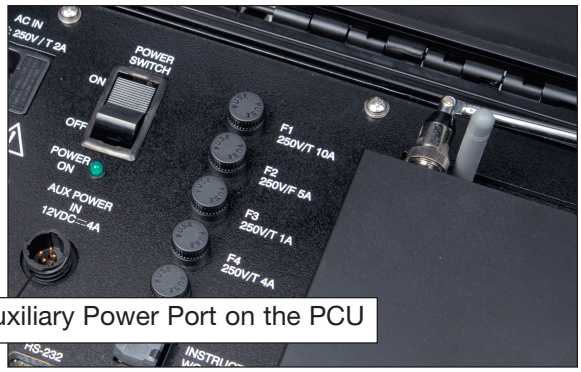
Connect the remaining end into a surge-protected AC power outlet.

Press the POWER SWITCH on the PCU into the ON position.

Connect the Ethernet Cable to the Workstation

If operating at a remote setting with the OPTIONAL Auxiliary Power Supply, connect the supplied power cable to the Auxiliary Power Supply before connecting the other end to the PCU port labeled AUX POWER IN 12VDC.

Power on the Auxiliary Power Supply before pressing the PCU POWER SWITCH to ON.



The Auxiliary Power Port on the PCU

Locating the PCU's Auxiliary Power Port

Step 11: Power On the Waveform Display Monitor

Press the power button on the front of the Waveform Display Monitor.

Power On the Waveform Display Monitor

Step 12: Power On the Instructor Workstation

To turn on the Instructor Workstation, open the laptop and press the power button located in the upper right-hand corner of the keyboard area.

Power On the Instructor Workstation

When using the OPTIONAL Wireless Remote Control, power on the remote unit by pressing the power button located on the keyboard area of the laptop.

Step 13: Set Up the Wireless Remote Microphone (If Desired)

To use the Wireless Remote Microphone, unfold the two antennas located behind the wireless receiver on the PCU, attach the lapel microphone, and verify that the handheld microphone transmitter base is set to the same channel as the receiver located on the PCU.

Software Basics

The BabySIM system utilizes METI HPS6™ software designed to run on the Apple™ Macintosh™ platform, taking advantage of the Mac operating system's powerful simulation-friendly features.

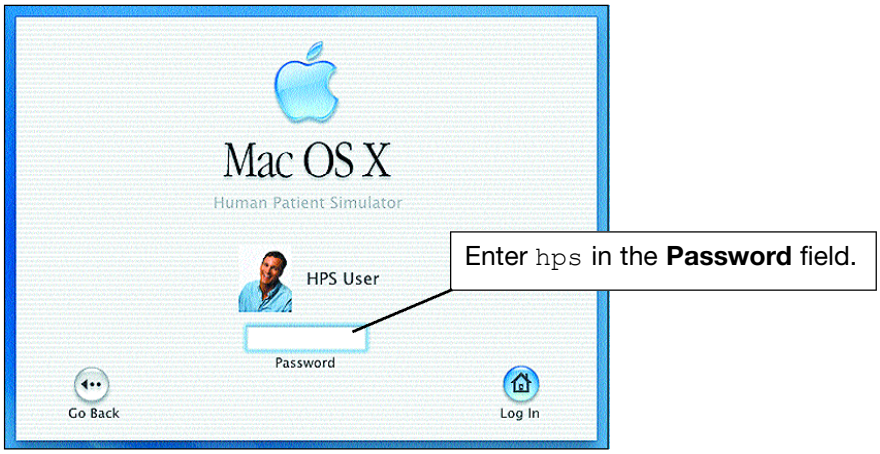
Macintosh Fundamentals

Some users are unfamiliar with Macintosh, but those familiar with PC operating systems should adapt quickly to the originator of the windows-based user interface.

Starting the Application

When the computer starts, a small Users window appears, displaying two choices, **Administrator** and **HPS User.**

1. Select **HPS User.** The Login window opens, displaying the **Password** field.



The Login Window

2. Enter `hps` in the **Password** field.
3. Click the **Login** button.

The HPS6 application launches, displaying the HPS menu bar and the Patient Palette. (The HPS menu bar the Patient Palette are discussed below.)

The HPS6 application should launch automatically with the Instructor Workstation.

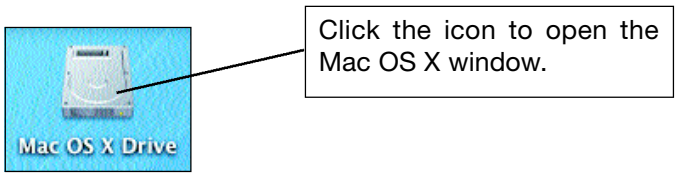
However, to manually start the HPS6 application, click the HPS6 Launcher located in the Dock. (The **HPS6 Launcher** and the **Dock** are discussed below.)

Understanding the Desktop

The Macintosh desktop configured for the Instructor Workstation displays all the functionality needed to operate the HPS6 software. Applications can be accessed either by opening the Mac OS X window or by using the shortcuts assigned to the Dock.

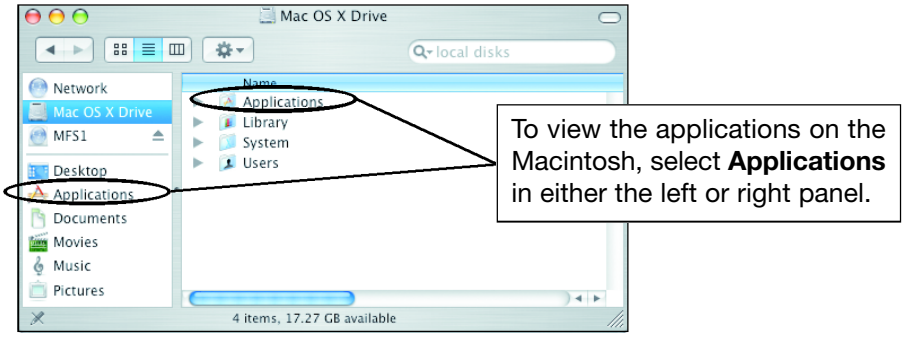
Opening the Mac OS X Window

The icon for the Mac OS X system hard drive is located initially in the upper right corner of the desktop.



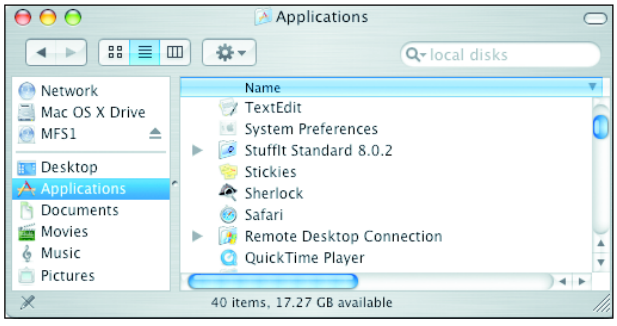
Mac OS X Icon

Clicking on this icon opens the window for the hard drive.



Mac OS X Window

Selecting **Applications** in either the left or right panel displays the applications available on the hard drive.

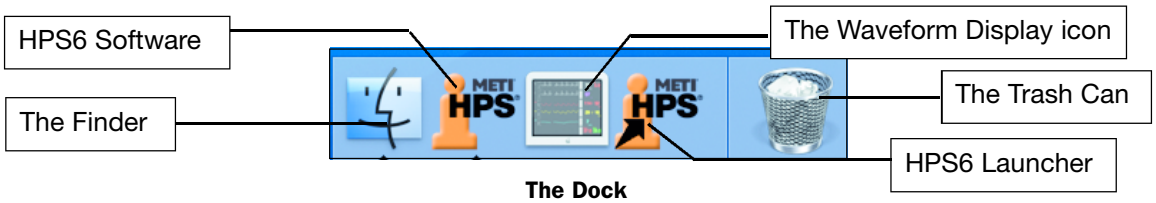


Available Applications

The applications on the Instructor Workstation include those programs, such as Text Edit, which contain standard features that may be useful when working with the HPS6 software.

Using the Dock

The Dock, initially located at the bottom of the desktop, displays shortcut icons to applications, open files that are currently minimized, and other items like the Finder and Trash Can.



The Dock

To open or activate a item in the Dock, click the icon for that item.

To add an application to the Dock, locate the application on the hard drive, select the application and drag it (see **Dragging** below) to the Dock.

To remove an icon, click on that icon and drag it off the Dock toward the desktop.

The Finder

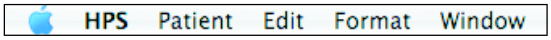
The Finder is always active and the Finder window can be accessed by clicking anywhere on the desktop or on the Finder icon in the Dock.

The Finder Menu

The Finder menu provides the tools for locating and managing files.

The HPS6 Launcher

The HPS6 application should open automatically when the Instructor Workstation starts. To manually launch the HPS6 application, click the HPS6 Launcher icon located in the Dock. Once the software is loaded, the HPS menu bar appears at the top of the window indicating that the HPS6 application is running.

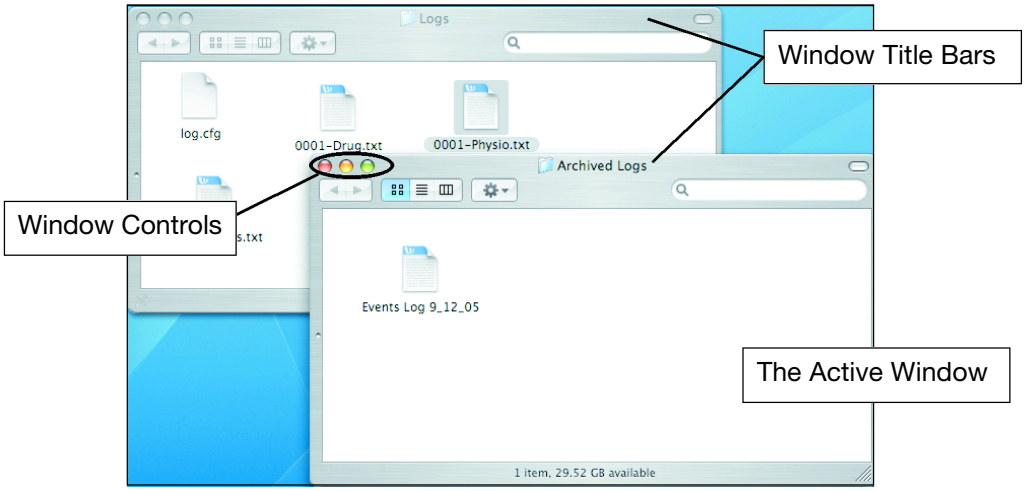


The HPS Menu

The HPS menu provides the basic functionality needed for opening and running the Patient software. Many of the options found on the menu are also located on the Patient Palette and the Patient window.

Working with Windows

A window is the main, rectangular area in which application elements are displayed. The elements in a window vary from application to application. There is almost no limit to the number of windows that can be open on the desktop at one time, but only one window at a time is active. The active window appears at the uppermost level of the screen and the controls of the active window are enabled. The title bar displays the name of the file that the window represents.



An Inactive and Active Window

Moving a Window

To move a window, click the window's title bar and drag the window to the desired location (see **Dragging** below).

Using Window Controls

The Window Controls are comprised of three colored buttons located in the upper left corner of the window.

Click the *green* (+) Maximize button to enlarge the window.

Click the *yellow* (-) Minimize button to reduce the window and place it as an icon in the Dock. To return the window to the desktop in its original size, click on the icon.

Click the *red* (x) Close button to close the window.

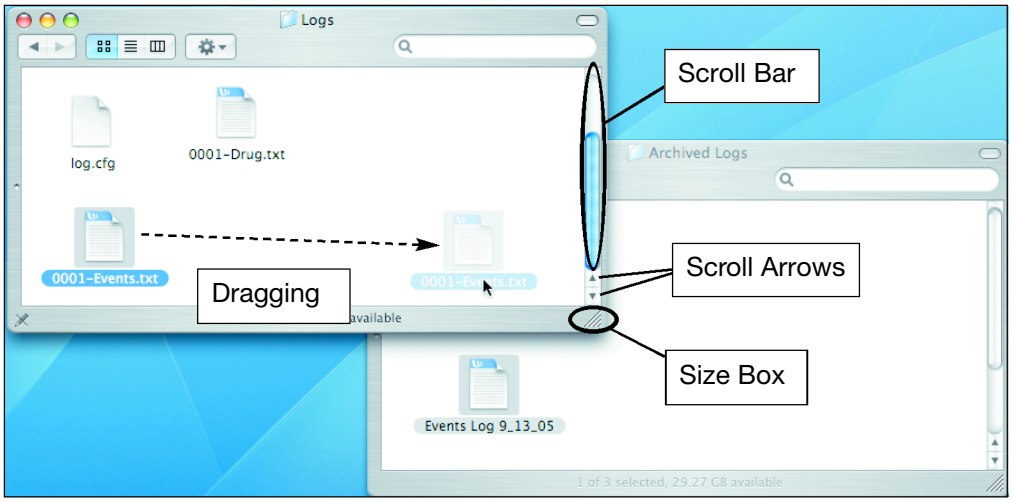
NOTE: Windows can also be closed and minimized by using the **Window** menu located on the application's menu bar.

Switching between Windows

To make a window active, click anywhere on an inactive window. The new active window moves to the foreground and title bar or the active window is highlighted. This action does not close any windows, but all other windows on the desktop remain inactive.

Dragging

To move an object on the screen, position the cursor over the object, press and hold the mouse button, move the object to the desired location and release the mouse button.



Window Features

Scrolling

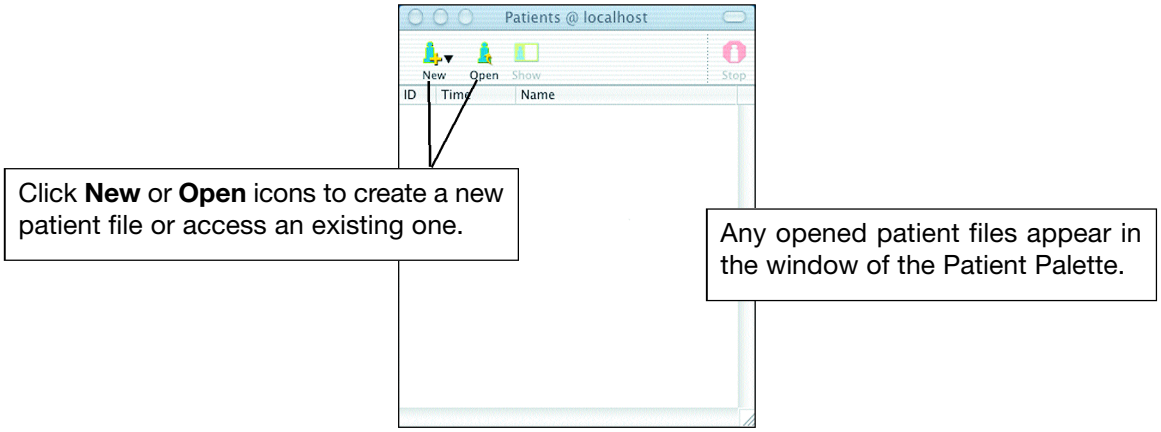
Windows that contain additional information that is out-of-view display scroll bars either along the right side or the bottom of the window. Moving the scroll box inside the scroll bar adjusts the view of the window's contents. Clicking a scroll arrow moves the document one line while holding down the scroll arrow causes continuous scrolling.

Resizing

Windows can be sized to any available dimension on the screen by dragging the Size Box located on the bottom right corner of the window.

Patient Start Up

When the HPS6 application is launched, a small window called the Patient Palette appears. The Patient Palette displays a list of all the currently running patients.

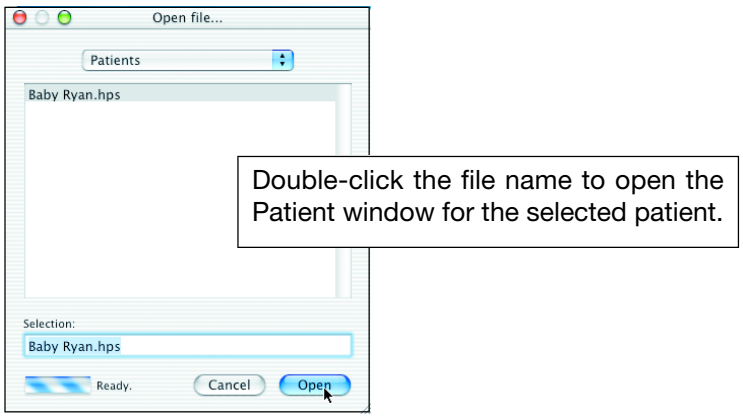


The Patient Palette

The toolbar icons (**New**, **Open**, **Show** and **Stop**) represent options that are also available on the HPS menu bar. The **Show** and **Stop** icons are disabled until a patient file is opened.

Opening a Patient File

Once the software is launched, open the preconfigured or any saved user-defined patient by clicking the **Open** icon in the upper left corner of the Patient Palette. The **Open File** window appears, displaying the available patient files.



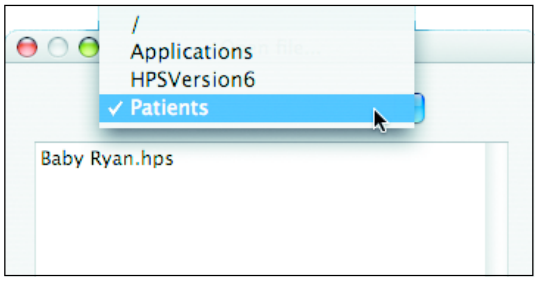
Opening a Patient File

Select the file and click the **Open** icon or double-click the file name to start the patient and open the Patient window.

Patient files can also be opened using the menu options or the shortcut keys found on the menu.

Locating Patient Files

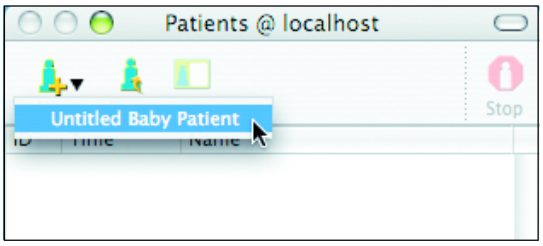
Patient files are generally stored in the **Patients** directory within the **HPSVersion6** folder. However, if files are saved in other locations, the drop-down menu on the **Open File** window can be used to navigate to the appropriate directory.



Navigating the Open File Menu

Creating a New Patient

To create a new patient, click on the **New** icon and select the **Untitled Baby Patient** option.



Creating a New Patient

The Patient Palette indicates that the system is preparing the untitled baby patient based on the underlying patient, Baby Ryan. By starting with Baby Ryan, who displays normal, healthy vital signs and physiology, new patients each have an established point from which to customize patient parameters. Once the new patient is prepared, the Patient window opens with the new, undefined patient. (The Patient window is described in detail on page 4.10.)

For complete details on creating a new patient, please refer to **Developing a New Patient** found in the **Using the System** section of this User Guide.

Using the Patient Menu

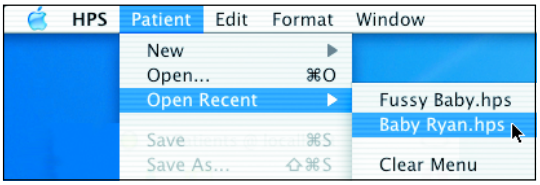
The **Patient** menu located on the HPS menu bar also contains the options for opening and creating new patients.

The Patient Menu

Several of these options can be used as alternatives to the buttons and icons on the Patient Palette and the Patient window. Options can be chosen by either selecting them with the cursor or by using the shortcut keys shown on the right.

Opening a Recent Patient File

As a shortcut, patients files that have been used recently can be opened from the HPS menu bar by selecting the **Open Recent** option from the **Patient** menu.



Opening a Recently Viewed Patient

The last ten patient files that have been opened are displayed in a menu to the right of **Open Recent**. Once a patient file is selected, the Patient window opens to display the corresponding patient.

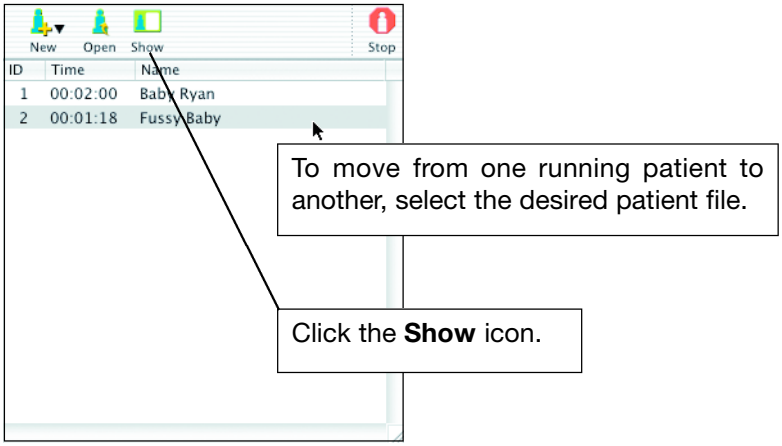
Utilizing Shortcut Keys

Many options shown on the HPS menu offer shortcut key alternatives that are displayed to the right of the option's name. For example, the **Save As...** option can be performed by simultaneously selecting the **Shift**, Command (the key with the and the cloverleaf icons), and **S** keys, represented by the symbols on the right.

Save As... Option with Shortcut Keys

Working with Multiple Patients

Whenever two or more patient files are running, it is possible to switch between patients by selecting the inactive patient file and clicking the **Show** icon on the Patient Palette.



Switching between Two Patients

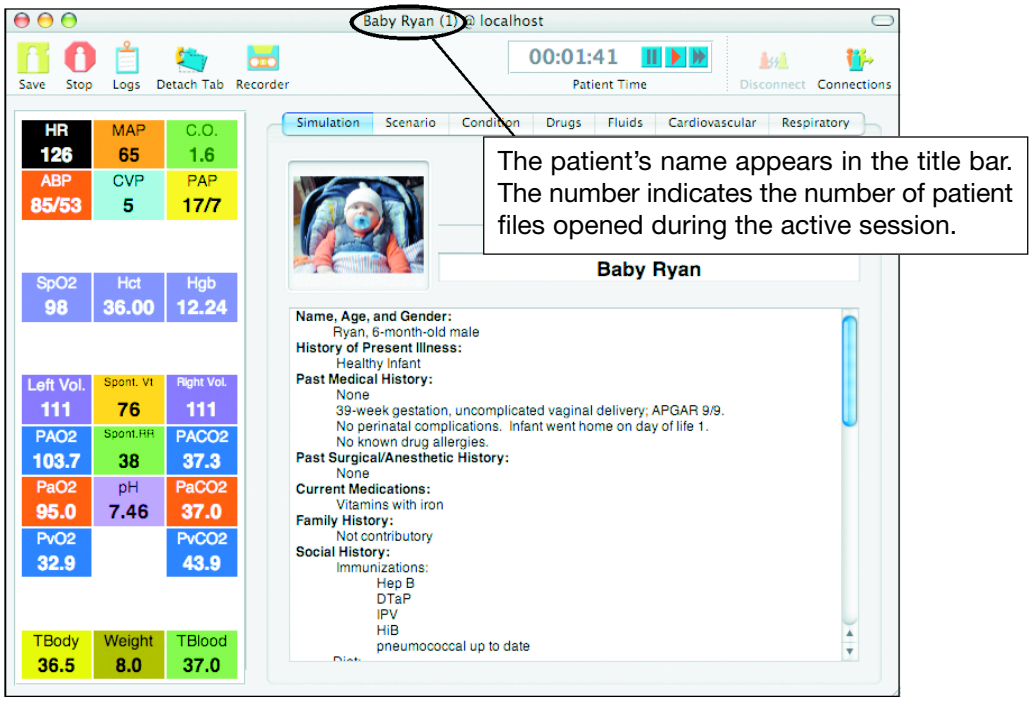
Once the new file is selected, the Patient window for that file appears in the foreground of the desktop. The previously viewed Patient window moves to the back.

Double-clicking the selected patient file also activates the desired Patient window.

Note: Open more than one patient slows computer performance and is not recommended.

The Patient Window

Once the patient file is prepared and loaded, the Patient window appears with the name of the patient (e.g. Baby Ryan) as well as the name of the host server (e.g. localhost).

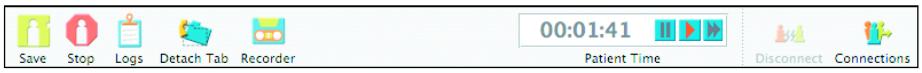


The Patient Window

This window serves as the primary user interface.

Using the Patient Toolbar Icons

The Patient toolbar is located beneath the title bar, displaying several icons used to provide basic system functionality.



The Patient Toolbar

Menu options for these functions can also be found on the HPS menu bar.

Save

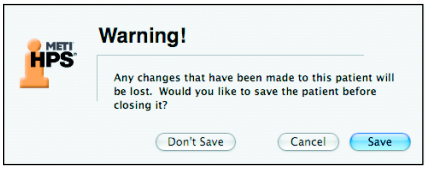
Clicking the **Save** icon saves the active patient file. Files can also be saved using the **Save** option located in the **Patient** menu or by simultaneously holding down the **S** and Command (⌘) keys.

When the **Save** icon is clicked, the current version of the patient file overwrites (replaces) the previous version. Preconfigured patients such as Baby Ryan cannot be overwritten, so selecting **Save** in this case prompts a warning requiring the patient to be saved to the user directory as a new patient file.

When saving a new patient file, the **Save file as...** window appears, providing the means of naming the patient file and navigating to a location in the directory where the file can be stored.

Stop

Clicking the **Stop** icon prompts a warning to save the patient file.



The Patient Toolbar

Clicking the **Save** button on the Warning box functions in the same way as choosing the **Save** icon (see **Save** above) while clicking **Cancel** returns the user to the Patient window without saving the file. Clicking **Don't Save** closes the active Patient window without recording any unsaved changes to the patient file.

The patient file can also be stopped by clicking the **Stop** icon on the Patient Palette.

Logs

Clicking the **Logs** icon opens the Logs Drawer at the bottom of the Patient window.

The Logs Drawer

The buttons on the Logs Drawer provide access to the **Event Log**, **Physiologic Data Log** and **Drug Log**. The menu option for showing the Logs Drawer is found under the **Window** menu in the HPS menu bar. When the Logs Drawer opens, the Event Log appears by default.

The Logs Drawer displays three buttons:

Event Log (default) - chronological list of parameter adjustments, fluid interventions and administered drugs

Physiologic Data Log - record of patient's heart rate, blood pressure, arterial blood gas values, temperatures and other numerous phsiological values.

Drug Log - chronological list of all drugs administered to the patient, either as a bolus or via an infusion

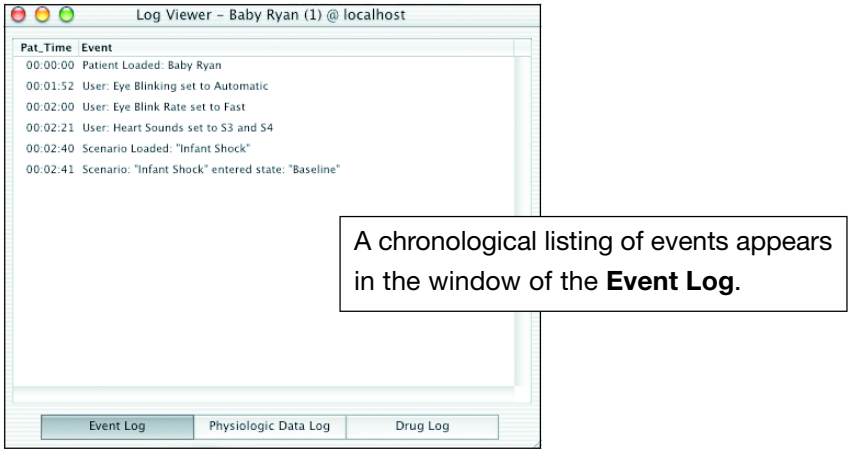
Each time the patient is started, the system automatically captures the information that is stored in these three logs. The files that represent this data are saved in the **Logs** folder located inside the **HPSVersion6** folder on the hard drive.

Clicking the Log Viewer button on the Logs Drawer creates a separate window for the selected log.

Opening a Log Viewer

The Event Log

The **Event Log** displays a chronological list of events that are time-stamped based on the simulated running time of the patient in hours, minutes and seconds.



The Event Log

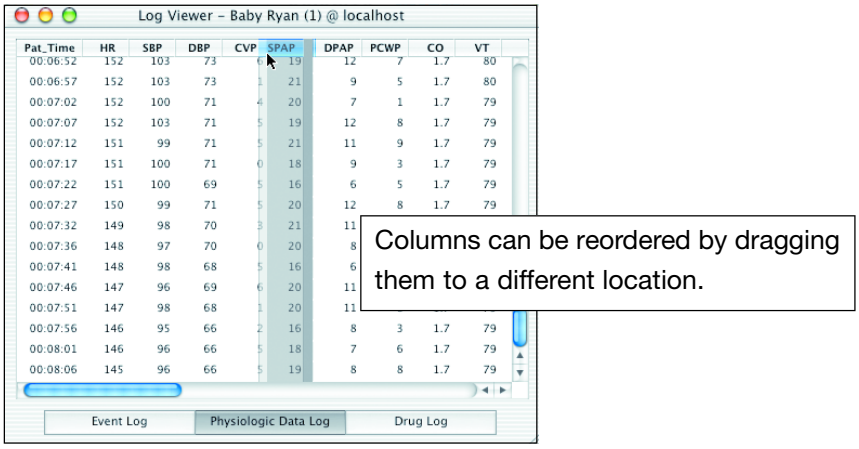
Parameter modifications and user interventions such as defibrillation or pacing are listed in the **Event Log**, which also document if the intervention was initiated by the user or resulted from a change specified in a running scenario.

The **Event Log** does not record events such as the application of a facemask to the patient, changes in ventilator settings or the auscultation of heart or breath sounds. Patient assessment or similar user interventions must be recorded independently.

The Physiologic Data Log

The **Physiologic Data Log** lists more than 20 different physiological parameters and is updated every five seconds and recorded based on the simulated time of the patient in hours, minutes and seconds.

The order in which the physiological data appears can be rearranged in both the Logs Drawer and the Log Viewer. To rearrange, click on the column header and drag the column to the desired location.



Moving Data in the Physiologic Data Log

Because a large amount of data is recorded in the **Physiologic Data Log**, the horizontal and vertical scroll bars can be used to locate needed information.

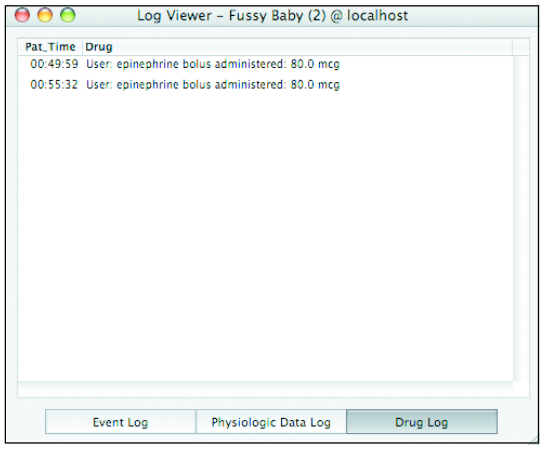
The Drug Log

The **Drug Log** records all drugs administered to the patient, either as a bolus or via an infusion.

Bolus dose logs display when the drug was given, the drug's name, the dose amount administered and the origin of the dosage (i.e. User or Scenario).

Drug infusion logs record when the infusion was started (or discontinued), the drug's name and the rate of infusion, either as dose per unit time or as the dose per kilogram per unit time (normalized infusion). An infusion is considered to be "running" at the set rate until the infusion is altered, turned off or the patient is stopped.

Each entry is recorded based on the simulated time of the patient in hours, minutes and seconds.

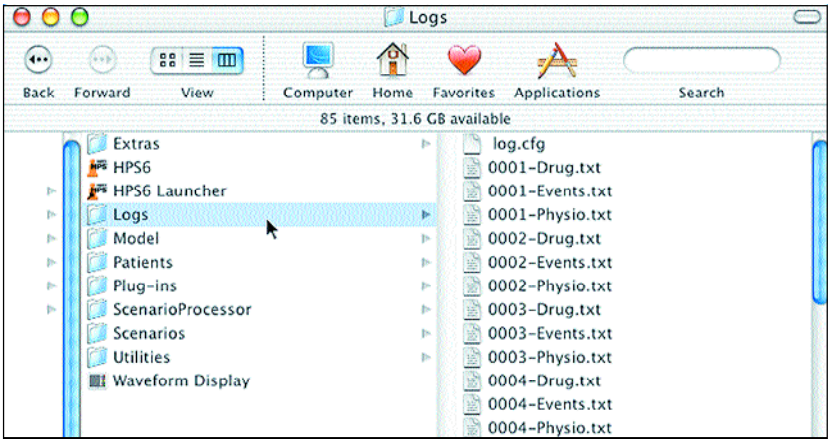


Bolus Data in the Drug Log

Bolus doses in the **Drug Log** are recorded as individual entries and are not the cumulative dose given to the patient. In the example shown above, a single epinephrine dose of 80 mcg followed by a second epinephrine dose of 80 mcg appears as two separate entries of 80 mcg and 80 mcg, not as one entry of 80 mcg followed by a total of 160 mcg.

The Logs Folder

The **Logs** folder holds the data files from each of the logs for every patient session. Located in the **HPSVersion6** folder, the **Logs** folder is accessed by navigating the Mac OS X drive (e.g. Applications/HPS6/Logs).



The Logs Folder

The three log files created for each session correspond to the **Drug**, **Event** and **Physiologic Data** logs for that session. A number is created sequentially as a prefix to each file (in groups of three) with the largest number representing the most recent session.

Detach Tab

When the **Detach Tab** icon is clicked, a separate window appears displaying the active tab.

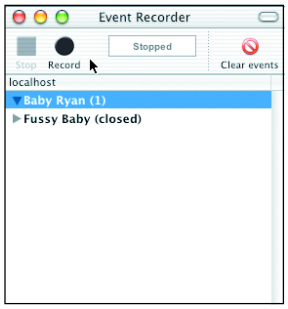
A Detached Simulation Tab

If a tab such as the **Conditions** tab has multiple menu options (e.g. **Trauma** and **Assessment**), then the active option is displayed in the new window. Multiple tabs can be detached and used to isolate specific controls. (For more information on tabs, see the **Tabs** section of this User Guide.)

The menu option for detaching tabs is found under the **Window** menu in the HPS menu bar.

Recorder

Clicking the **Recorder** icon opens the **Event Recorder**, a separate window that initially displays a list of the patients opened during the current session.

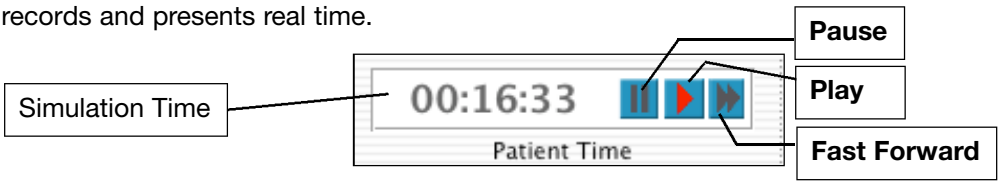


Event Recorder

To record events, select the patient and click the **Record** button. Each event created using the parameters available under the various tabs is recorded and listed in the Event Recorder window. To stop the recording process, click the **Stop** button. To clear an event, select the event and click on the **Clear events** button. The menu option for displaying the **Event Recorder** is located under the **Window** menu in the HPS menu bar. For more information, see **Using the Event Recorder** on page 6.36.

Patient Time

The **Patient Time** display keeps track of the simulation time. By default, the digital readout records and presents real time.



Patient Time

Three buttons appear to the right of the readout showing icons for the **Pause**, **Play** and **Fast Forward** functions. The active button has a red icon.

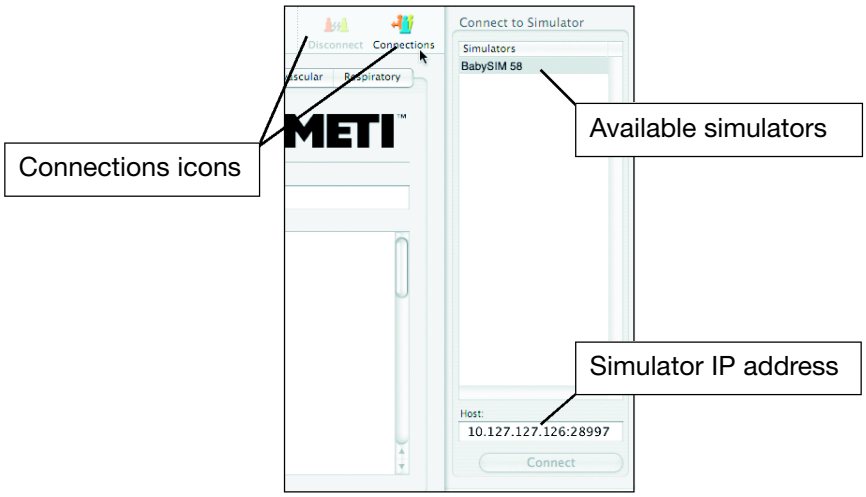
Pause - "freezes" the simulation in its current state. Any ongoing parameter changes, drug effects or scenario events remain suspended until either the **Play** or **Fast Forward** buttons are clicked. While time is paused, all parameters cycle through a continuous loop of approximately 10 seconds. Changes made during the use of **Pause** are not saved or put into effect.

Play - runs the physiological models in real time. Parameter changes, drug effects and scenario events play out at their normal, model-driven rate.

Fast Forward - runs the physiological models at approximately four times normal speed. Parameter changes, drug effects and scenario events continue at an accelerated pace until either the **Pause** or **Play** buttons is clicked. Spontaneously breathing patients breathe at an accelerated rate.

Connection Icons

The two connection icons, **Disconnect** and **Connections,** appear on the right side of the Patient toolbar. Clicking the **Connections** icon opens the **Connect to Simulator** drawer.



Connection Icons and Connect to Simulator Drawer

A list of available simulators appears in the **Connect to Simulator** drawer.

Select the appropriate simulator and click **Connect**

or

Double-click on the appropriate simulator.

Even if only one simulator is present (which is often the case), the connection process must be followed.

When the software and simulator are successfully connected, the connection drawer closes and the **Disconnect** icon is enabled.

To close the drawer without connecting to the simulator, click on the **Connections** icon. To disconnect the software from a patient mannequin, click on the **Disconnect** icon.

To switch the simulator from one active patient to another:

1. Select the simulator in the **Connect to Simulator** drawer and click the **Disconnect** button at the bottom of the drawer.
2. Select the desired patient file in the Patient Palette and click the **Show** icon.
3. Select the simulator in the **Connect to Simulator** drawer and click the **Connect** button at the bottom of the drawer.

Viewing the Heads Up Display (HUD)

The Heads Up Display (HUD), located on the left side of the Patient window, displays twenty-three selected patient parameters that register the patient's physiological condition.

The Heads Up Display (HUD)

When adjustments are made to the parameters in the software, the underlying models determine all the appropriate physiological changes, and the effects of the adjustments appear on the HUD.

HUD Parameters			
Parameter	**Name**	**Units**	**Notes**
HR	Heart Rate	bpm (beats/min)	
MAP	Mean Arterial Pressure	mmHg	
CO	Cardiac Output	lpm (liters/min)	
ABP	Arterial Blood Pressure	mmHg	
CVP	Central Venous Pressure	mmHg	
PAP	Pulmonary Arterial Pressure	mmHg	
SpO_2	Pulse Oximeter Saturation	%	
Hct	Hematocrit	%	Determined dynamically based on blood and fluid losses and intravenous infusion of colloid, crystalloid, packed red blood cells and whole blood, hence helping determine the O_2 transport in the blood.
Hgb	Hemoglobin	g/dl	
Left Vol.	Left Lung Volume	ml	Measured volume inside the mannequin, ideally, the alveolar volume.
Spont. VT	Spontaneous Tidal Volume	ml	Not a measured volume, but a desired tidal volume generated by the models. Tidal volumes measured at the patient circuit (mechanical ventilation) generally do not match the value displayed in the HUD and often report a value less than the desired tidal volume.
Right Vol.	Right Lung Volume	ml	Measured volume inside the mannequin, ideally, the alveolar volume.
PAO_2	Alveolar Oxygen	mmHg	The partial pressures of respiratory gases (CO_2 and O_2) in the patient's alveoli. A software model of the lungs controls these values.
Spont. RR	Spontaneous Respiratory Rate	bpm (breaths/min)	Determined by the underlying physiological models. For a spontaneously breathing patient, this value should match the observed respiratory rate of the mannequin. For a mechanically ventilated patient, Spont. RR does not match the value displayed on the ventilator.
$PACO_2$	Alveolar Carbon Dioxide	mmHg	The partial pressures of respiratory gases (CO_2 and O_2) in the patient's alveoli. A software model of the lungs controls these values.
PaO_2	Arterial Oxygen	mmHg	
pH	pH	(unitless)	Respiratory acidosis or alkalosis simulated in real time depending on the alveolar concentration of O_2.
$PaCO_2$	Arterial Carbon Dioxide	mmHg	
PvO_2	Venous Oxygen	mmHg	
$PvCO_2$	Venous Carbon Dioxide	mmHg	
TBody	Body Temperature	˚C	Not tied to the underlying physiological models. Fahrenheit unavailable.
Weight	Patient Weight	kg	Sets the patient's weight used by the pharmacological models. The patient's body mass index and body structure cannot be altered or defined.
TBlood	Blood Temperature	˚C	Linked to the oxyhemoglobin dissociation curve. Thus, hyperthermia causes a rightward shift, while hypothermia causes a leftward shift to the standard oxyhemoglobin dissociation curve. Beyond this, not tied to the underlying physiological models. Fahrenheit unavailable.

Working with Tabs

Beneath the toolbar on the right side of the Patient window is a series of tabs that provide access to the physiological controls used during a simulator exercise.

The Seven Tabs

The tabs display seven different categories offering varying functionality:

Simulation (default) - view patient information and medical history

Scenario - run and create patient scenarios

Condition - set parameters for assessment and trauma conditions

Drugs - administer drugs

Fluids - affect plasma and blood volumes

Cardiovascular - set a wide array of parameters affecting cardiovascular physiology

Respiratory - control airway, lung and respiratory control parameters

Clicking on a tab displays the functionality available for selecting and setting parameters within the identified category. Several categories are further divided into sub-categories found on a pull-down menu.

Each of the tabbed categories, sub-categories and patient parameters are discussed individually in the **Tabs** section of this User Guide.

Numeric and Discrete Parameters

On the **Condition**, **Cardiovascular** and **Respiratory** tabs, parameter settings provide a large number of alternatives creating a wide range of physiological responses.

There are two types of settings for parameters:

Numeric - set either a measured value (e.g. 20 ml) or a multiplied value (e.g. Heart Rate Factor 2.0 is two times the baseline Hear Rate)

Discrete - select one of two or multiple options

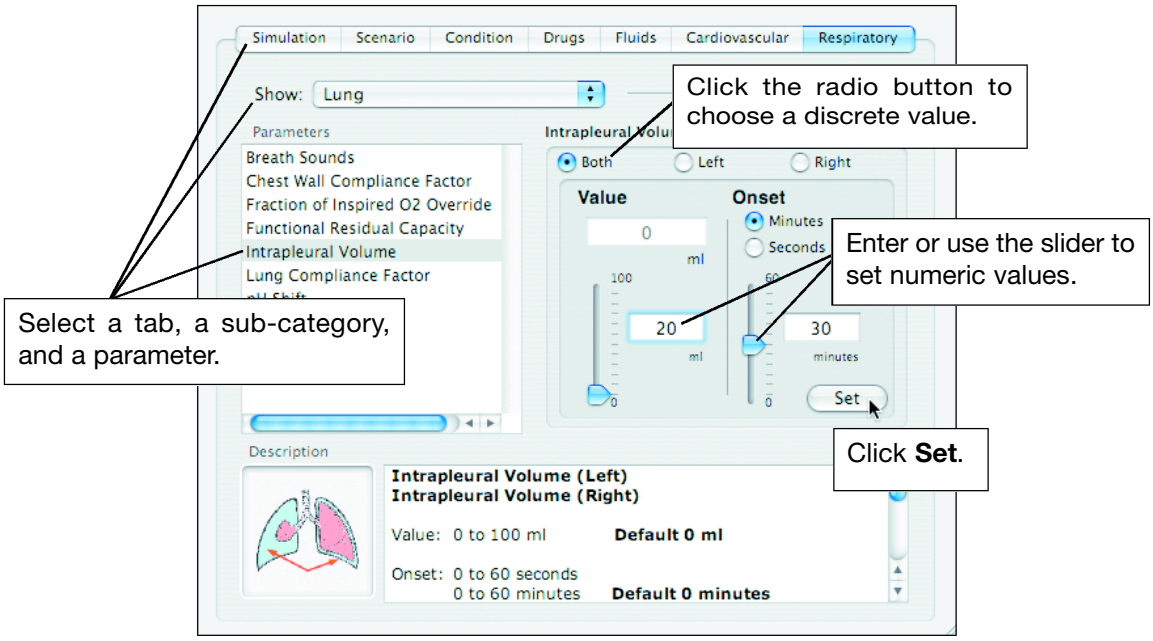
Once a parameter is selected and set, the patient's physiology changes according to the model for that parameter.

Parameters with numeric settings are generally changed by clicking in the relevant field and entering a new value in place of the existing one. A slider is available that moves through the range of parameter values until established at the desired numeric value.

Parameters with discrete settings are changed by clicking on the appropriate radio button.

Parameter Settings

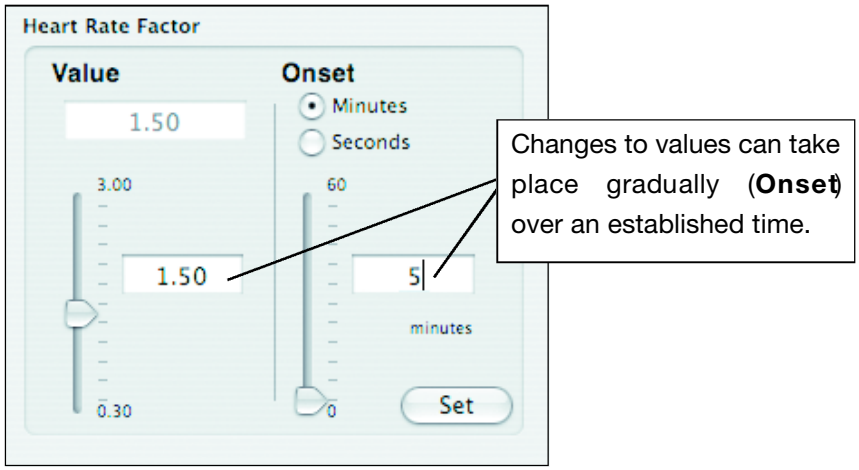
Once a parameter is selected, the panel to the right displays the available settings.



Setting Values for Parameters

Click the radio buttons for the desired discrete values and enter or use the slider to establish the numeric values. Then, click the **Set** button.

The new parameter values immediately begin to affect the patient's physiology. Depending on the parameter and its settings, changes can be dramatically instantaneous or can take place more slowly over time.



Values Increasing Over 5 Minutes

In the example above, the **Heart Rate Factor** is set to increase 1.5 times over 5 minutes. Gradually, the effects of this change will appear on the HUD as the heart rate increases. If the **Onset** time had been set to 0 (the default), the change would have taken place immediately.

In some instances, the parameter setting produces a model-driven response.

Six parameters have this capability:

Fixed Neuromuscular Blockade (located under **Assessment** on the **Condition** tab)

Fixed Heart Rate (located under **Heart** on the **Cardiovascular** tab)

Fraction of Inspired O_2 Override (located under **Lung** on the **Respiratory** tab)

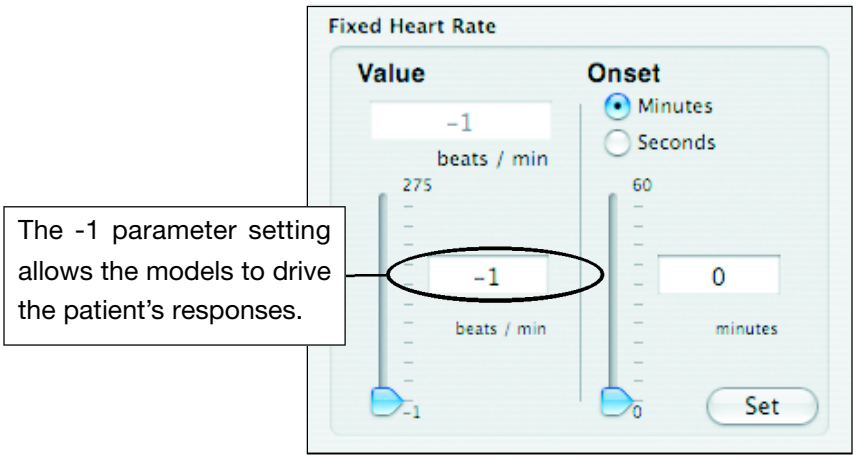
Fixed Neuromuscular Blockade (located under **Respiratory Control** on the **Respiratory** tab)

Respiratory Rate Override (located under **Respiratory Control** on the **Respiratory** tab)

Tidal Volume Override (located under **Respiratory Control** on the **Respiratory** tab)

These parameters all have a default setting of -1 that signals the software to perform physiological changes based on the models without instructor intervention.

In the example below, setting the **Fixed Heart Rate** to -1 means the heart rate automatically rises when the selected patient becomes hypovolemic. The loss of volume is factored into the mathematical models and results in a compensatory rise in the simulator's heart rate.



A Model-Driven Parameter

Setting the value to any other number (e.g. 60 beats/min) fixes the parameter at that number regardless of the underlying patient physiology or user intervention.

Saving Data

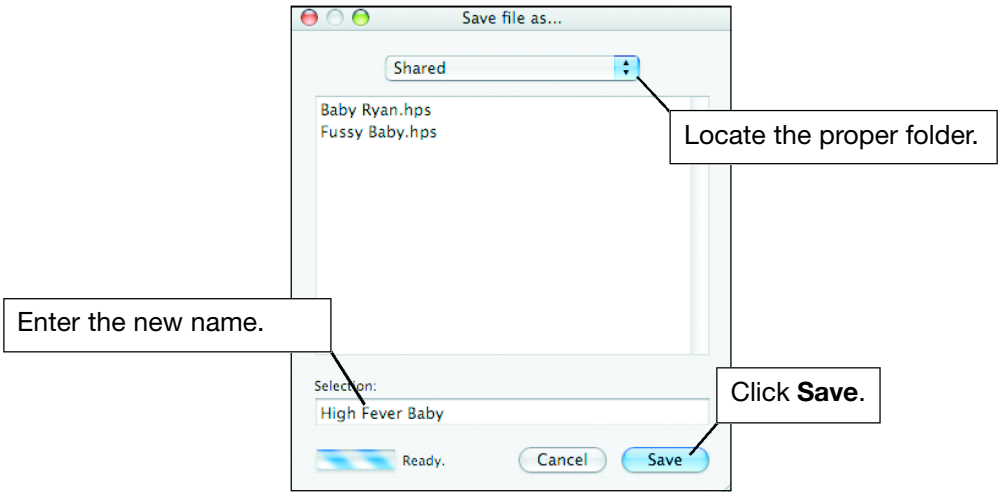
Patient information can be saved locally on the hard drive or transferred to external storage via a CD or a USB memory device. Files are created in a simple text (TXT) format. Consequently, transferred files can be printed on any computer (PC or Mac) that has printing capability.

Backing up files is especially important when custom patients and scenarios have been created. Whenever important files exist, it is recommended that the files be stored on a second source and a hard copy of the records be generated.

Saving Patient Files

Before the Patient window is closed, the patient file can be saved using either the **Save** icon on the Patient window or the **Save** or **Save As** options located on the **Patient** menu. Clicking the **Stop** icon on the Patient window also prompts a warning that provides an option to save.

If the file is being saved for the first time, the **Save file as...** window appears.



Saving a New Patient File

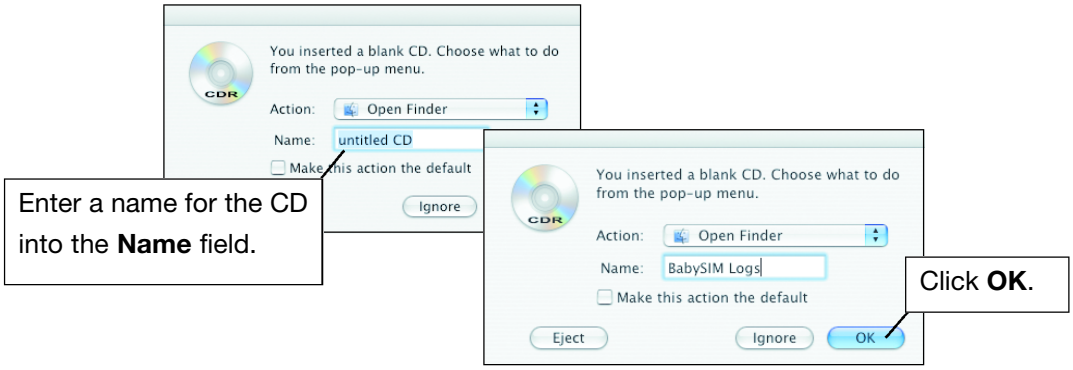
Enter the new name in the **Selection** field and click **Save**.

Patient files should be stored at a preset location in the Users/Shared folder. The navigational pull-down menu at the top of the window provides the means for locating the appropriate folder.

Saving to a CD

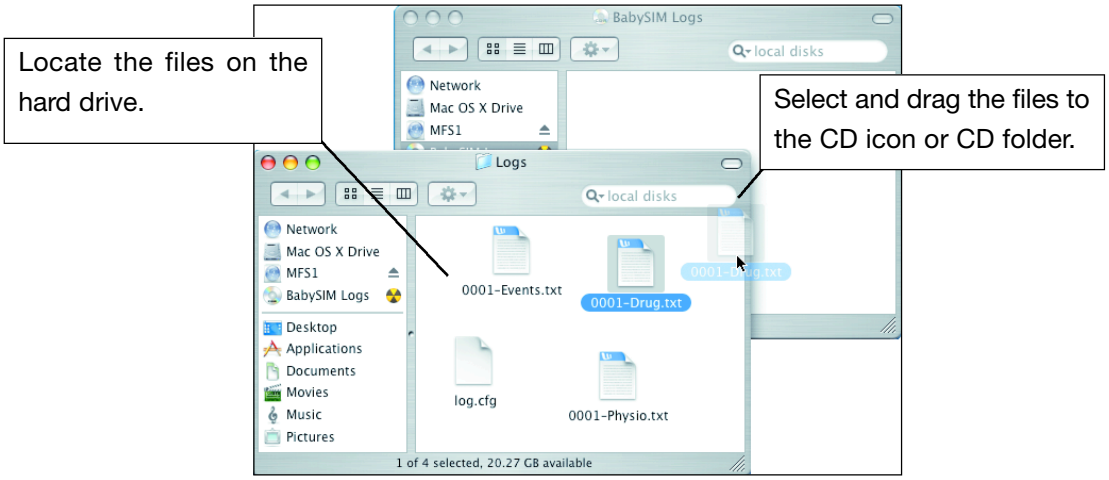
To save to a CD-ROM:

1. Insert a blank CD in the CD drive at the front of the Instructor Workstation. A dialog box appears with a field highlighted by default for labeling the CD.



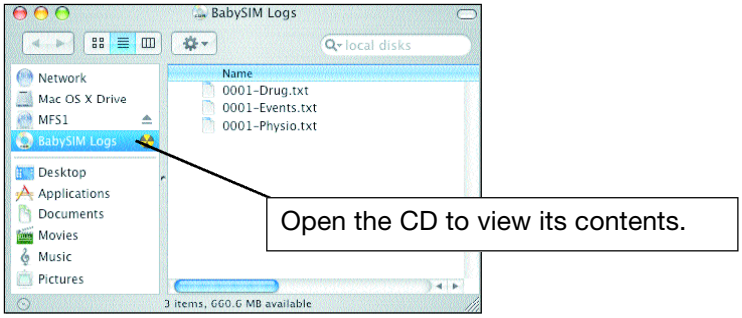
Naming the CD

2. Enter the new name in the **Name** field (overwriting the default name).
3. Click **OK**.
4. Locate the folder with the information you wish to save (e.g. log files, custom patients, custom scenarios).
5. Select and drag the appropriate files from the drive to the CD.



Dragging Files to a CD

6. Double-click on the CD icon to open the window for the CD and confirm the files have been copied.

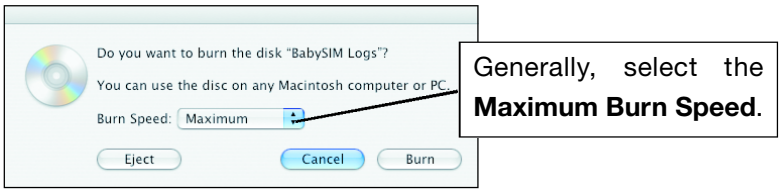


CD Contents

7. Drag the CD file to the Trash icon on the Dock. When the CD file is over the Trash, the icon changes to a Burn CD icon.

Burning a CD

A dialog box appears with the options to **Burn**, **Cancel** or **Eject**.



Burn CD Dialog Box

CDs can also be burned by selecting the **File** menu from the Finder and then selecting the **Burn Disc** option.

Click the **Burn** button on the dialog box. Once burning is complete, the CD reappears on the desktop.

To remove the CD from the CD-ROM drive, drag the CD file to the Trash icon in the Dock. The icon changes to an Eject icon, and the CD is ejected.

CDs can also be ejected by selecting the CD file and choosing the **Eject** option from the Finder's **File** menu or by pressing the **F12** key.

Ejecting a CD

Saving to a USB Memory Device

To save to a USB memory device:

1. Insert the USB memory device into an available USB port on the back of the Instructor Workstation. An icon appears on the desktop indicating that the memory device has been recognized.

USB Memory Device Icon

2. Locate the appropriate folder on the hard drive under HPSVersion6 containing the file(s) to be saved.
3. Drag the file(s) from the folder on the hard drive to the memory device icon on the desktop. The files are copied automatically onto the device.
4. Drag the icon to the Trash to disconnect the memory device.
5. Remove the memory device from the USB port.

Printing Files

Printing may not be performed from the Instructor Workstation. Instead, transfer the needed files to a CD or USB memory device and insert the CD or memory device into a computer with printing capabilities.

HPS files are saved in a text (TXT) format, so either a PC or Macintosh system can be used to print the files.

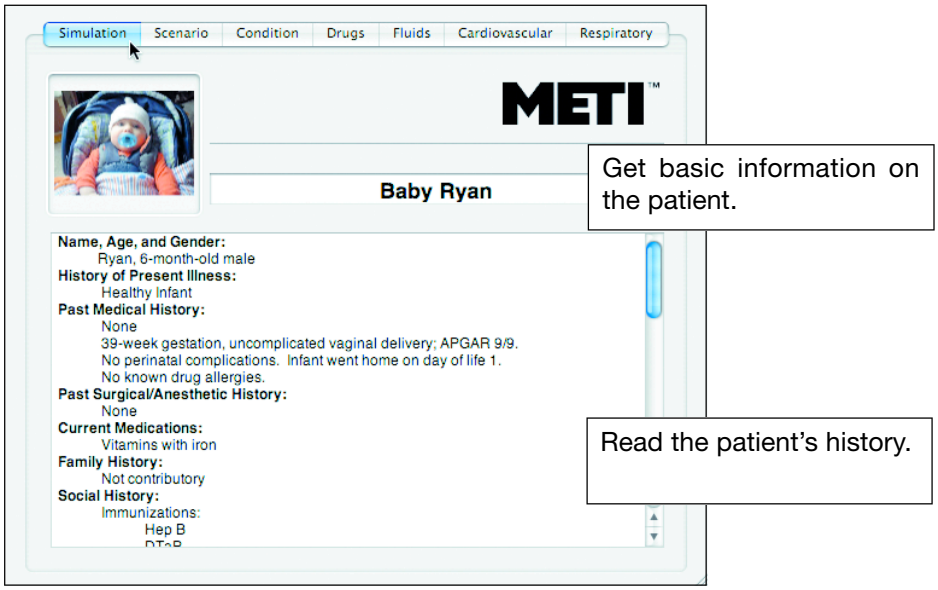
Saving as a Text file removes most formatting. To print in the most readable format, open the file and reformat the document. The contents of the text document can also be selected, copied, and pasted into word processing software for further modification.

Tabs

Patient physiology and background is created and controlled through the HPS6 software using the patient parameter settings in tabbed sections that organize all of the various parameters by system and functionality.

The Simulation Tab

The **Simulation** tab appears when the patient file is opened. This tab provides basic information about the patient such as the patient's name, history and photograph.

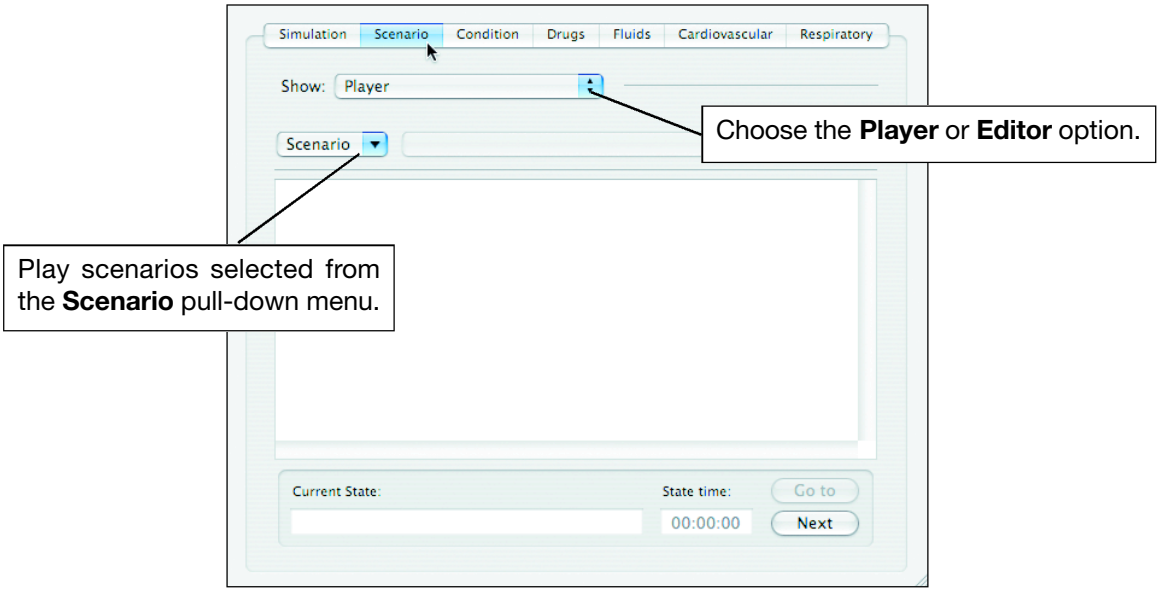


The Simulation Tab

Information on user-created patients must be provided by the instructor or administrator. For details on **Developing a New Patient** see pages 6.2 and 6.3 of this User Guide.

The Scenario Tab

Selecting the **Scenario** tab opens a window providing the tools needed to create or play patient scenarios that duplicate clinical situations by automatically simulating patient responses to a series of events.



The Scenario Tab

By default, **Player** is selected in the **Show** pull-down menu and the Scenario Player is displayed on the **Scenario** tab.

Initially, four preconfigured scenarios are available in the Scenario Player for the infant patient:

Increased ICP

Infant Shock

RSV Bronchiolitis

Sedation Induced Apnea

These scenarios can be played by selecting them from the **Scenario** pull-down menu. Additional scenarios can be created or scenarios can be modified using the Scenario Editor displayed by selecting the **Editor** option from the **Show** pull-down menu.

The **Editor** option is discussed later in this section on page 5.9.

Playing Scenarios

Any patient may be selected for any available scenario; however, patients with preestablished conditions may not work well with scenarios anticipating a patient with a different physiological status. For example, selecting a patient with profound neuromuscular blockade for a scenario expecting a spontaneously breathing patient will not yield the results expected by the scenario author.

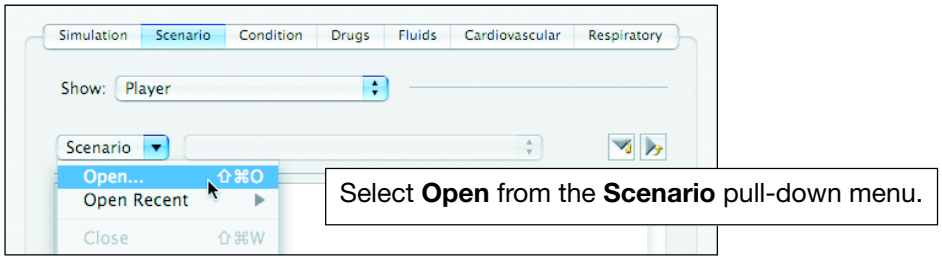
To play a scenario:

1. Open the scenario using the **Scenario** pull-down menu on the Scenario tab.
2. Navigate between the states of the scenario by using the buttons at the bottom of the **Scenario** tab.
3. Add interventions (learner, instructor, or automatic) when desired.

Patients respond realistically to all scenario events and interventions.

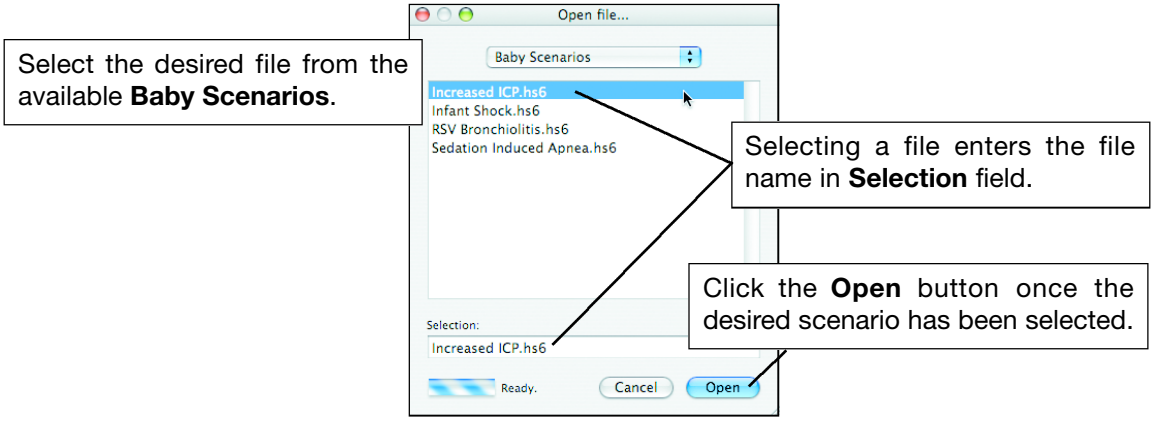
Opening a Scenario

To open a scenario, select either **Open** or **Open Recent** from the **Scenario** pull-down menu.



Opening a Scenario

Selecting **Open** activates the **Open file** window, displaying the available scenario files.



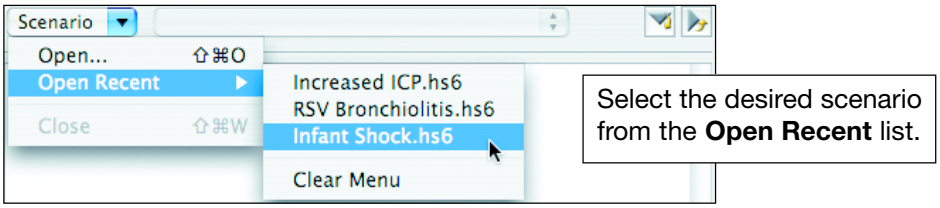
Selecting a Scenario File

In the the **Open file** window:

1. Locate the folder that contains the scenarios using the navigational pull-down at the top of the window. (The preconfigured scenarios are located in the **Baby Scenarios** folder shown in the example above.)
2. Select the desired scenario file.
3. Click **Open** (or double-click on the scenario file).

The chosen scenario appears in the Scenario panel.

When you select **Open Recent** from the **Scenario** pull-down menu, the most recently used (with a limit of ten) scenarios appear as options.



Opening a Recently Used Scenario

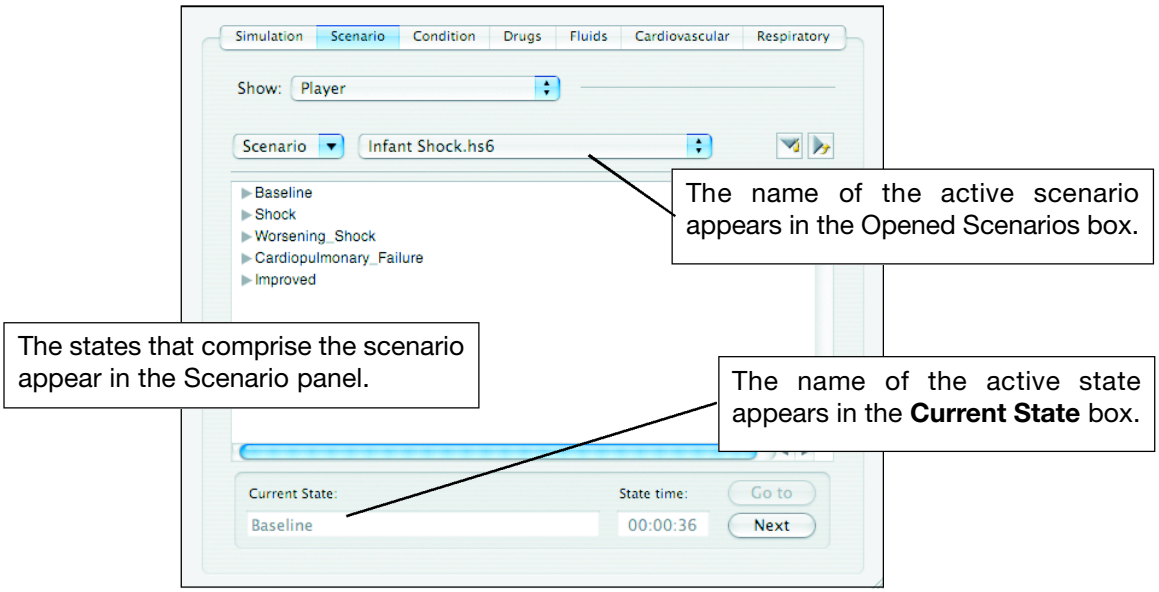
Select the desired scenario from the list.

The chosen scenario appears in the Scenario panel.

Multiple scenarios can be opened at one time. Additionally, it is possible to run multiple patients with multiple scenarios, but doing so may result in a drop in the computer's performance.

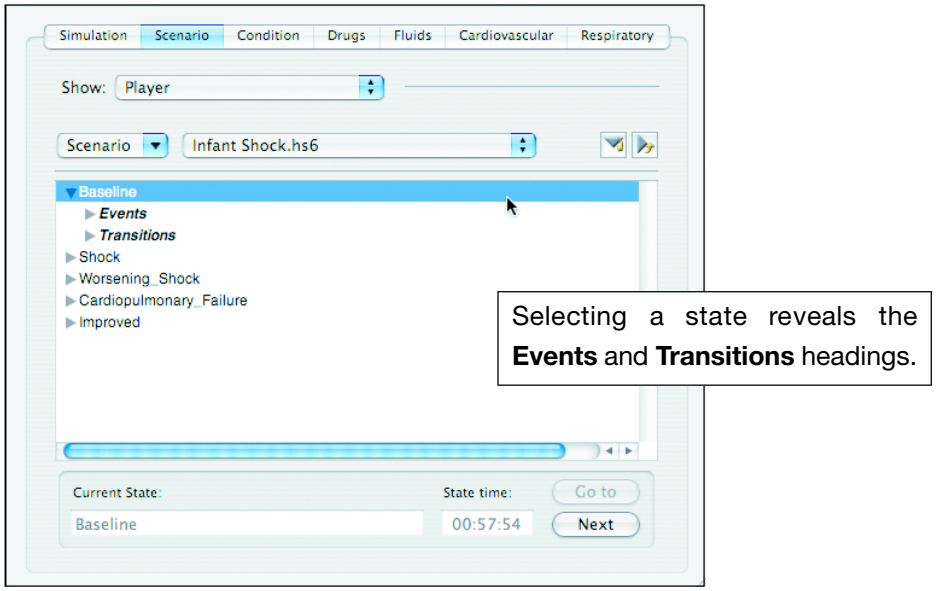
Understanding the Scenario Script

When a scenario appears, the states that comprise the scenario appear in the Scenario panel.



An Opened Scenario

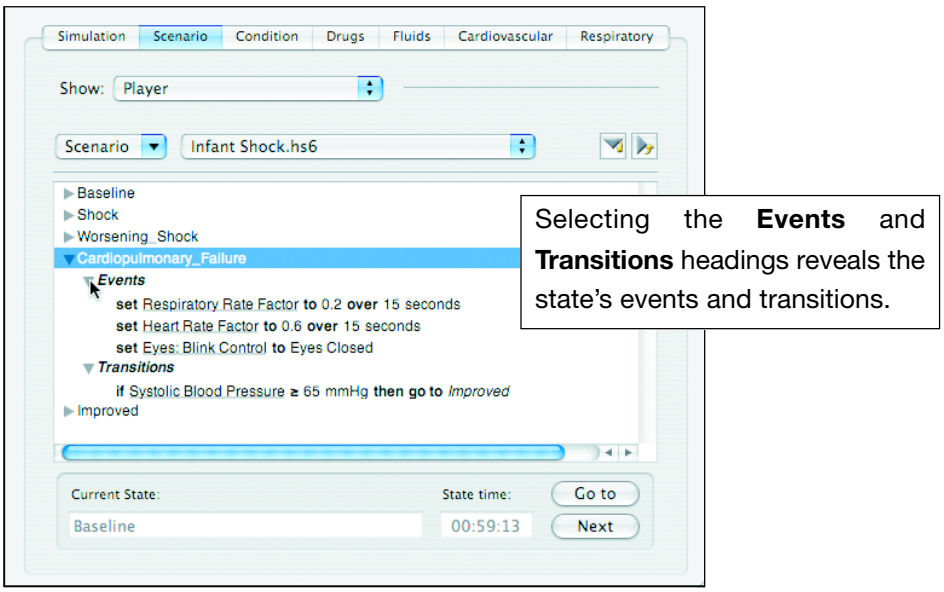
The simulation begins in the first listed state. In the example above, this state has been labeled **Baseline**. Selecting a state reveals the **Events** and **Transitions** headings for that state.



Selecting a State

Each state contains both headings, but not all states have events and/or transitions.

Select a state's **Events** or **Transitions** heading to see the events or transitions for that particular state.



Expanding Events and Transitions

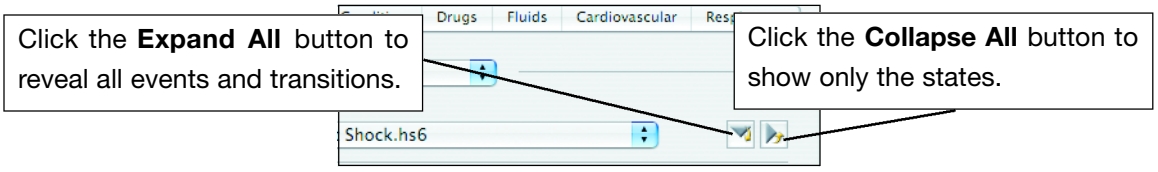
States may contain any number of events and/or transitions.

Events set specific parameters that take place when a state is active. Certain events are set to take place over a period of time.

Transitions offer conditional parameters that take place only when (and if) conditions are met.

As an example, the event "set Temperature: Arterial blood to 37 degrees Celsius" automatically changes the patient's blood temperature to 37.0 degrees Celsius, which is reflected in the readouts on both the HUD and on the monitor. On the other hand, the transition "If Time in State is > 30 seconds then go to Worsening Shock" occurs only if the selected state remains active beyond 30 seconds. At this point, the scenario would automatically go to the state labeled Worsening Shock.

To view all the events and transitions for a scenario, click the **Expand All** button.



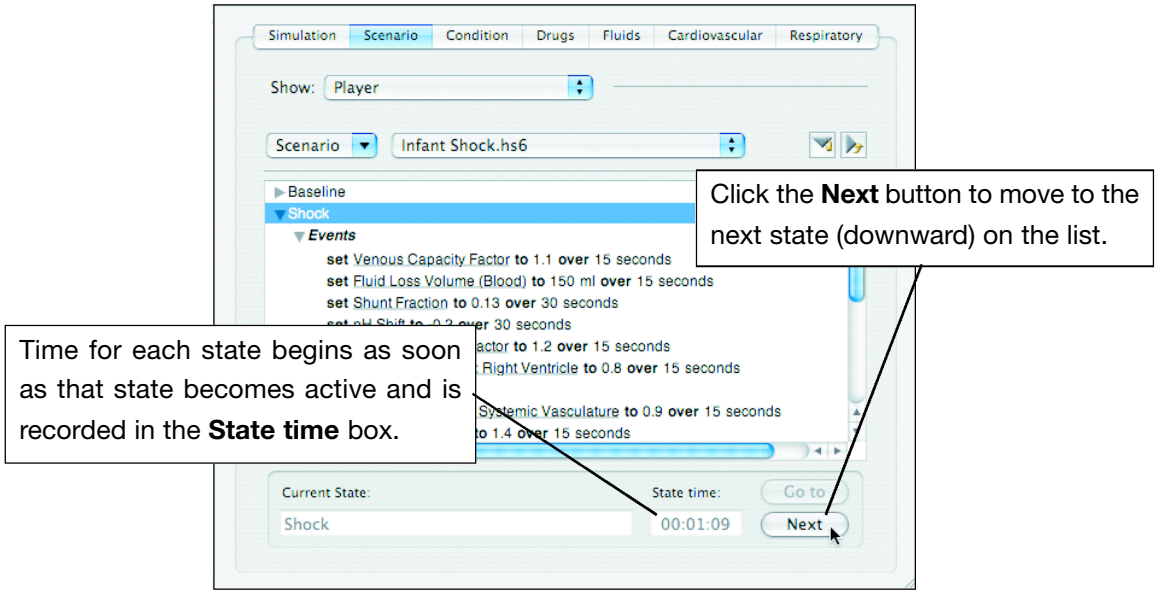
Expand All and Collapse All Buttons

Click the **Collapse All** button to return to a view showing only the scenario's states.

Navigating between States

Generally, scenarios are designed with states that occur beginning at the top and ending at the bottom. The preconfigured scenarios included with BabySIM are designed in this fashion. However, scenarios can be created that intentionally skip or repeat states, often depending on the nature of the intervention. Since scenarios are usually developed with a specific order in mind, reversing or altering that order may cause unrealistic results.

To move from the active state to the state that follows, click the **Next** button.

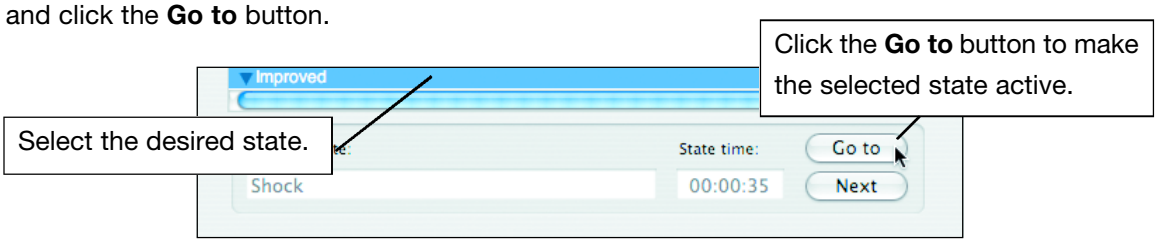


Moving from One State to the Next State

The name of the new active state appears in the **Current State** box and the time that state has been active is shown in the **State time** box.

In the example above, clicking **Next** while the **Baseline** state is active makes the **Shock** state, the next state in sequence, the active state.

To move from the active state to any other state (no matter the sequence), select the desired state and click the **Go to** button.

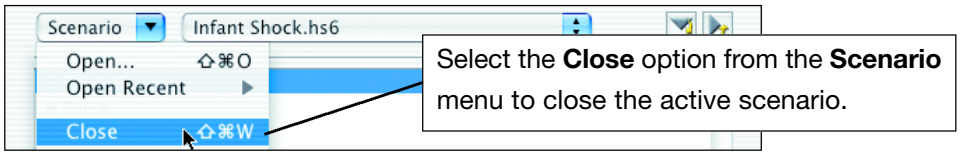


Changing States with the Go to Button

The selected state becomes active and its name appears in the **Current State** box.

Closing Scenarios

Scenarios run until closed. To close a scenario, select the **Close** option from the **Scenario** menu.



Closing a Scenario

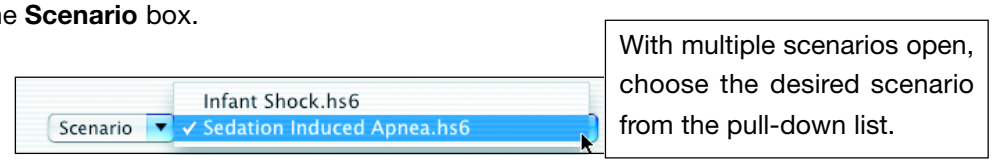
Even though a scenario has closed, the physiological changes made to the patient during the scenario remain.

Working with Multiple Scenarios

The patient's condition may be affected by events from any active scenario; therefore, running multiple scenarios enables the instructor to alter patient physiology using the states defined in more than one scenario.

Switching Scenarios

To switch between multiple open scenarios, select the desired scenario from the pull-down list to the right of the **Scenario** box.



Switching between Open Scenarios

The selected scenario becomes available for manual adjustments, but the physiological changes dictated by both scenarios continue to take place.

It is also possible to simultaneously run multiple patients with scenarios, but this is not recommended because computer performance is often hampered when two or more patients and the Waveform Monitor Display are operating.

Repeating Scenarios

The physiological changes made to the patient remain unless returned to their baseline numbers by further events and transitions in the scenario. In other words, the condition of the patient retains the effects of the scenario events unless specifically reset.

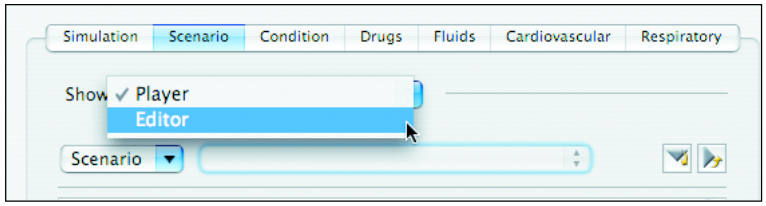
To be sure that a scenario is identically repeated, close the original scenario and stop the patient. Then, reopen the same patient and open the same scenario.

Editing Scenarios

In addition to the four preconfigured scenarios, new or revised scenarios can be created and saved using the Scenario Editor.

To create or edit a scenario:

1. Select the **Editor** option from the **Show** menu at the top of the Scenario tab.



Selecting the Scenario Editor

2. Select the **New**, **Open** or **Open Recent** option from the **Scenario** menu to choose whether to create a new scenario or to open and edit an existing one.

3. Add states, events and transitions as desired by selecting the **New State**, **New Event** and **New Transition** options from the **Scenario** menu.

4. Save the new or modified scenario using the **Save** or **Save As** options from the **Scenario** menu. Naming the file using the **Save file as** navigational window during the Save function also names the scenario.

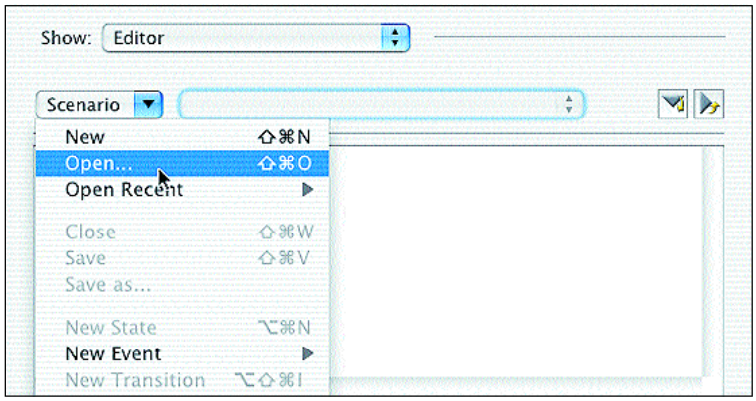
Once a scenario has been saved to a folder on the hard drive, that scenario is available for all patients.

A more detailed explanation of the method of editing and creating scenarios is contained in the pages that follow.

Modifying Existing Scenarios

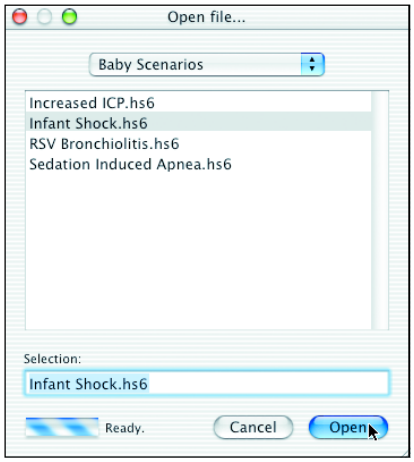
Either to permanently change or to create a new version of an existing scenario, in the Scenario Editor:

Open an existing scenario by selecting the **Open** or **Open Recent** option from the **Scenario** menu.



Opening an Existing Scenario

When **Open** is selected, the **Open file** window appears, providing the navigational tools to locate, select and open the appropriate scenario file.



Opening the Scenario File

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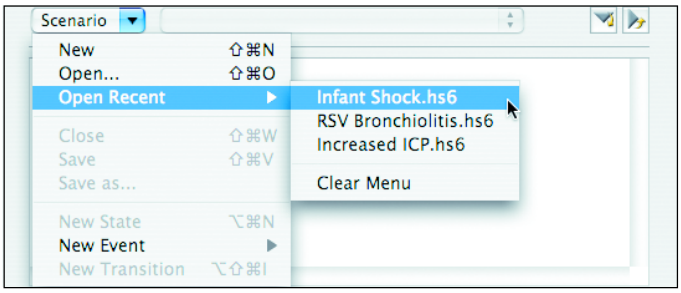
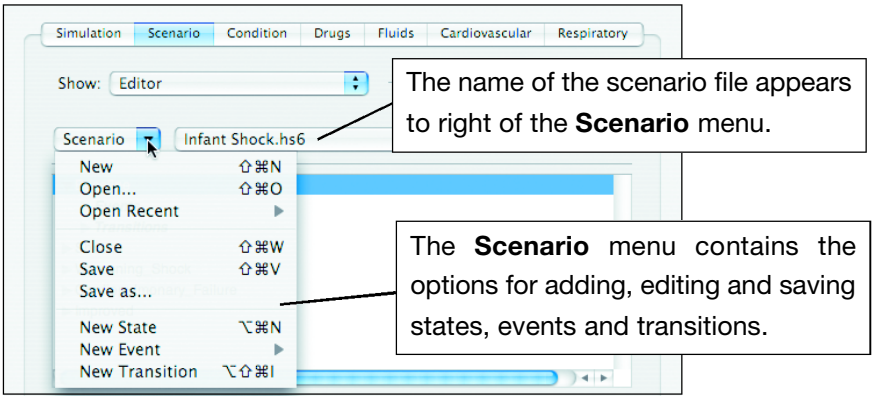
Selecting the **Open Recent** option displays the most recently used (with a limit of ten) scenarios as options.



Opening a Recently Used Scenario

The scenario file opens in the Scenario Editor. When the opened scenario appears, options become active for adding, editing and saving states, events and transitions on the **Scenario** menu.

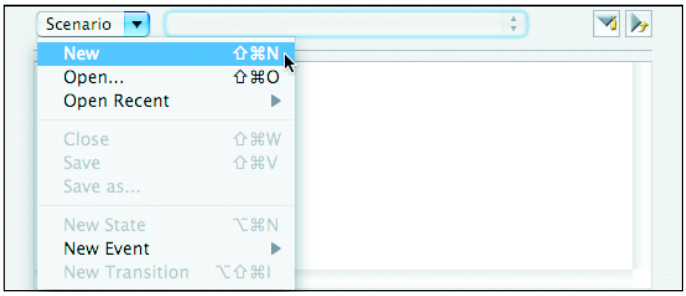


The Editor's Scenario Menu

See below for details on adding or editing new states (page 5.13), new events (page 5.16) or new transitions (page 5.28).

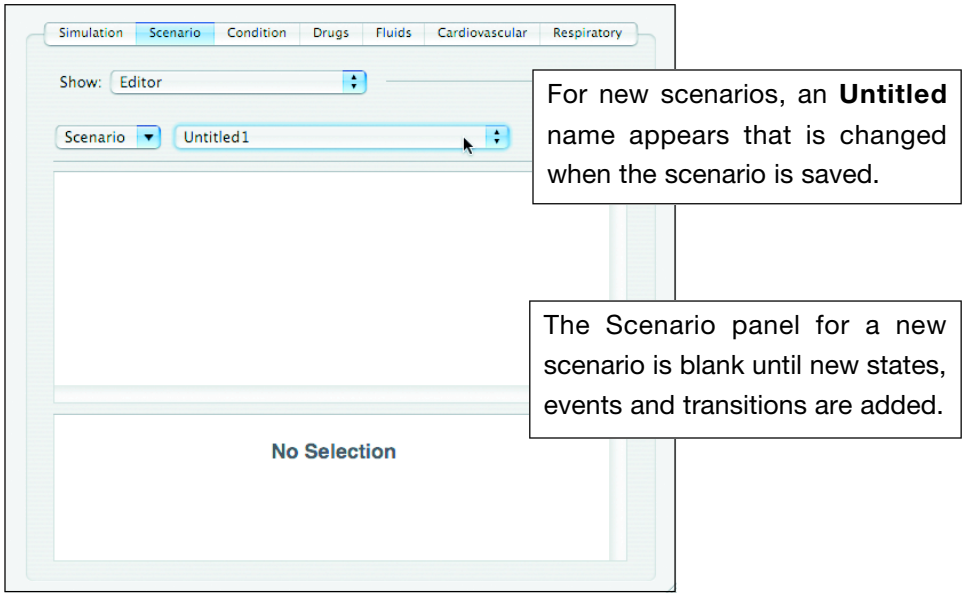
Developing New Scenarios

To create a new scenario in the Scenario Editor, select **New** from the **Scenario** menu.



Opening a New Scenario

The new scenario initially displays only an **Untitled** name and a blank Scenario panel.



The New Scenario's Initial Panel

Once the Untitled scenario appears, options are available on the **Scenario** menu for adding states, events and transitions as well as for saving the new scenario.

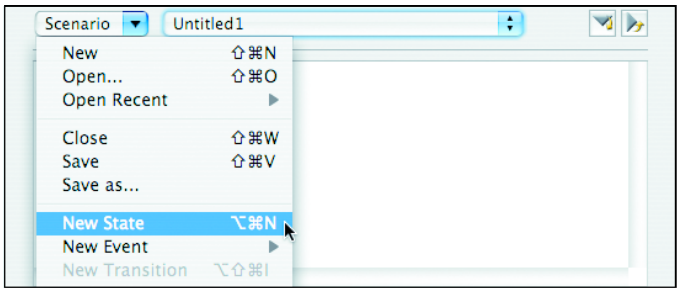
See below for details on adding or editing new states (page 5.13), new events (page 5.16) or new transitions (page 5.28) or for saving the scenario (page 5.34).

Adding, Editing and Deleting States

Scenarios are organized by the states that are simulated with the patient as diagnoses and interventions take place. As organizing structures, states by themselves do not cause changes to the patient's physiology. Those occur based on the events and transitions defined for the state.

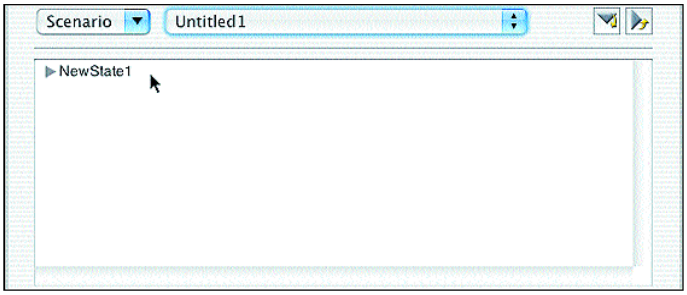
States are added in a set sequence and cannot be moved. Creating states in the order they occur in the scenario enables easier navigation using the **Next** button, but navigation can occur in any order and scenarios may involve skipped or repeated states, dependent on user intervention. (See **Navigating between States** on page 5.7.)

To create a new state, select the **New State** option from the **Scenario** menu.



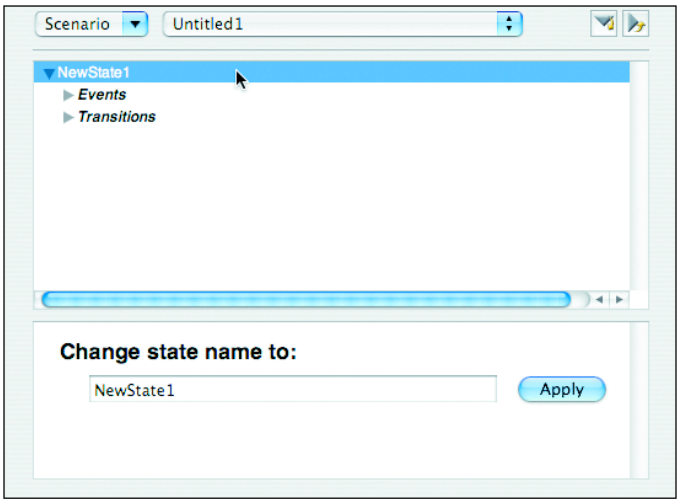
Selecting a New State

The new state (initially named **NewState**) appears in the Scenario panel.



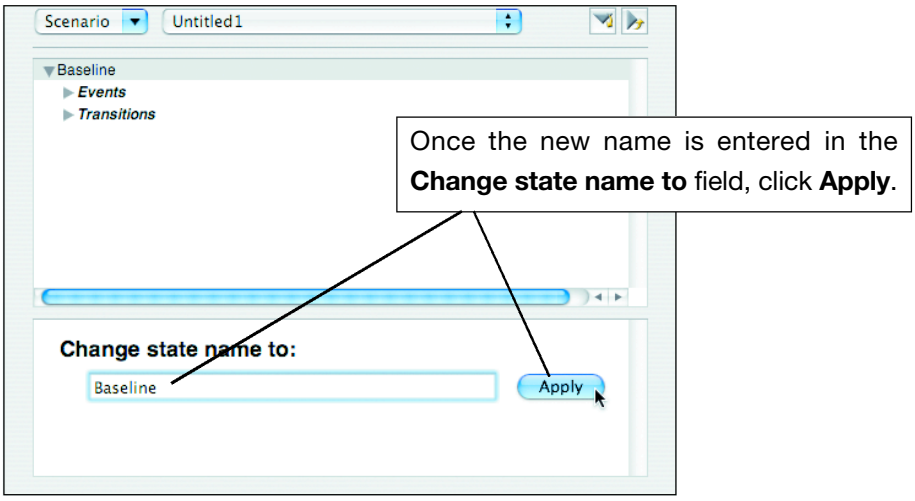
Selecting a New State

Select **NewState** to display the **Events** and **Transitions** headings and to activate the **Change state name to** field in the lower panel.



Displaying a New State

Enter the new name in the **Change state name to** field and click the **Apply** button (or press the **Enter** button on the keyboard).



Renaming a New State

The new name appears in the Scenario panel.

To edit the name, select the state in the Scenario panel, highlight the old name in the **Change state name to** field, enter the new name, and click **Apply**.

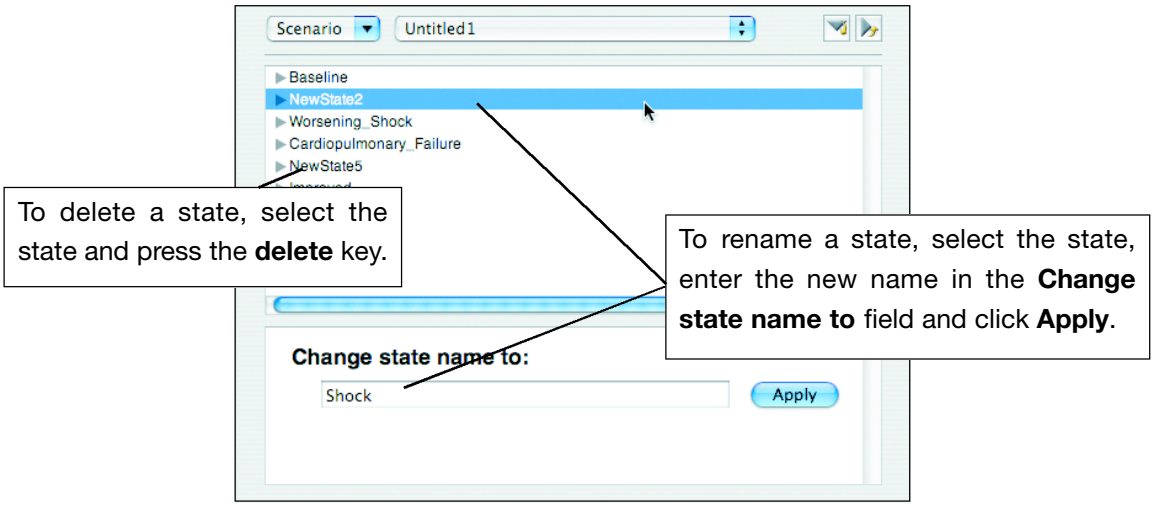
To delete the state, select the state in the Scenario panel and press the **delete** key. Deletions are irreversible. Always be sure that the state is not needed before performing the delete function.

Selected states can also be deleted by selecting the **Clear** option from the **Edit** menu.

After creating the state, events and transitions are added to define the state. (See below for details regarding adding events and transitions.)

Additional states in the scenario are added in order and cannot be moved.

If the exact sequence of states is unknown when the scenario is first being created, it may be helpful to add unidentified states between known states to ensure a proper progression of states when the scenario is finished. These unidentified states can then be later defined as necessary intermediated states or deleted if they are unneeded.



Editing State Names and Deleting States

States can be deleted by first selecting the state and then choosing **Clear** from the **Edit** menu or pressing the **Delete** key.

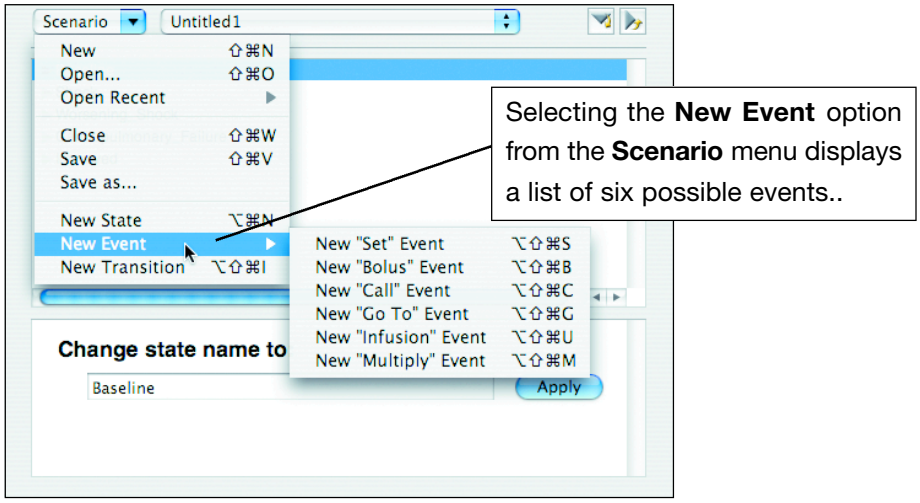
All events and transitions defined for the deleted state are also deleted.

Adding, Editing and Deleting Events

Events set the specific parameters that take place when the state is active. An event may alter a parameter (e.g. increase the Heart Rate Factor), administer a drug (bolus or infusion) or trigger the move to a new destination within the scenario.

To add events to a state:

1. Select the state in the Scenario panel
2. Choose an option from the list displayed by selecting the **New Event** option from the **Scenario** menu.



Editing State Names and Deleting States

3. Set the parameters for the event. (The type of parameter is determined by the type of event.)

Editing an Event

Once an event has been created, it can be modified by selecting it and entering new values for its parameters. This occurs in the same way that the event was created and defined.

Deleting an Event

To delete an event, select the event and press the **delete** key. Deletions are irreversible. Always be sure that the event is not needed before performing the delete function.

Events can also be deleted by selecting them and then selecting the **Clear** option from the **Edit** menu.

There are six different options for new events:

New “Set” Event

New “Bolus” Event

New “Call” Event

New “Go To” Event

New “Infusion” Event

New “Multiply” Event

Each of these options has a unique purpose and different parameter settings.

“Set” Events

A “set” event establishes a specific parameter within a scenario. All adjustable parameters (i.e. numerical and discrete) can have a “set” event. A parameter that has a “set” value remains unaffected at that setting until changed by another event.

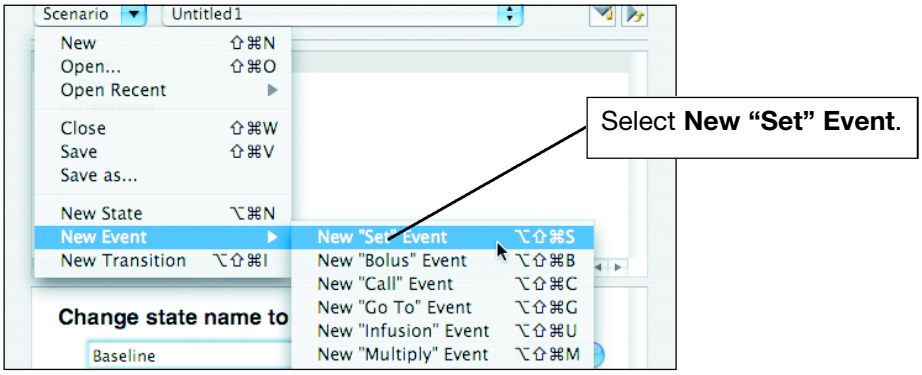
In some cases, the “set” event can have an “onset” time, thereby allowing for smoother hemodynamic or respiratory changes. For example, the event **set Heart Rate Factor to 1.5 over 1 minute** changes the Heart Rate Factor parameter from the patient’s default value to a value of 1.5 over a minute’s time. In these cases, the destination value (e.g. 1.5) can be greater than or less than the starting value.

When a parameter is set to a specific value, the instructor can change the parameter to a new value to override the scenario’s instructions. However, if an “onset” time is established in the scenario instructions, it is NOT possible to override the command until the onset of the value has completed.

To establish a “set” event:

1. Select the appropriate state.

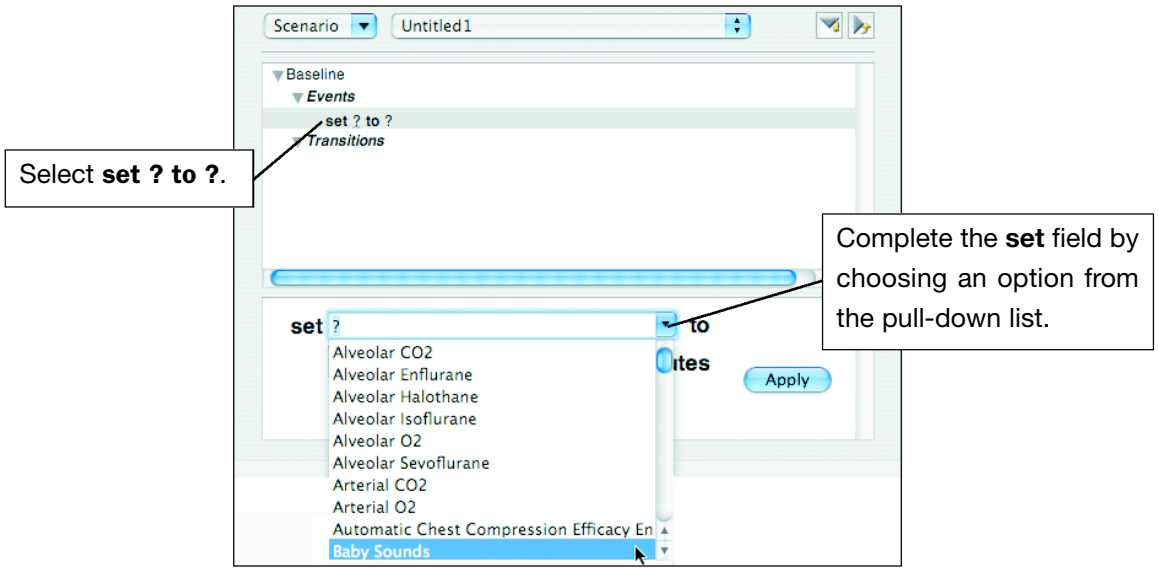
2. Choose **New “Set” Event** from the **New Event** option of the **Scenario** menu.



Selecting a New “Set” Event

The phrase **set ? to ?** appears beneath the **Events** heading of the selected state.

3. Select **set ? to ?**. The lower panel changes to display three fields beginning with the **set** field.

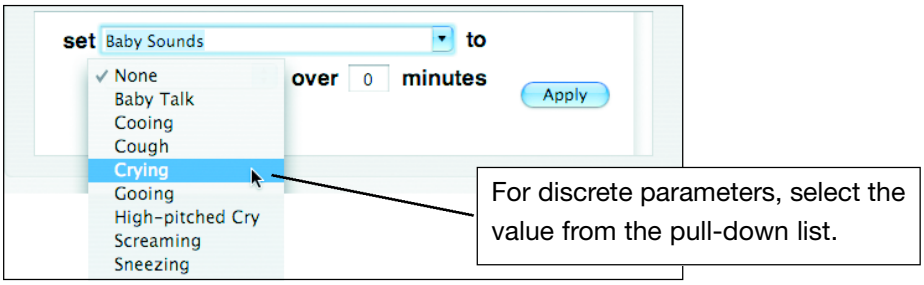


Selecting a Parameter to Set

4. Using the pull-down list, complete the **set** field by selecting the parameter.

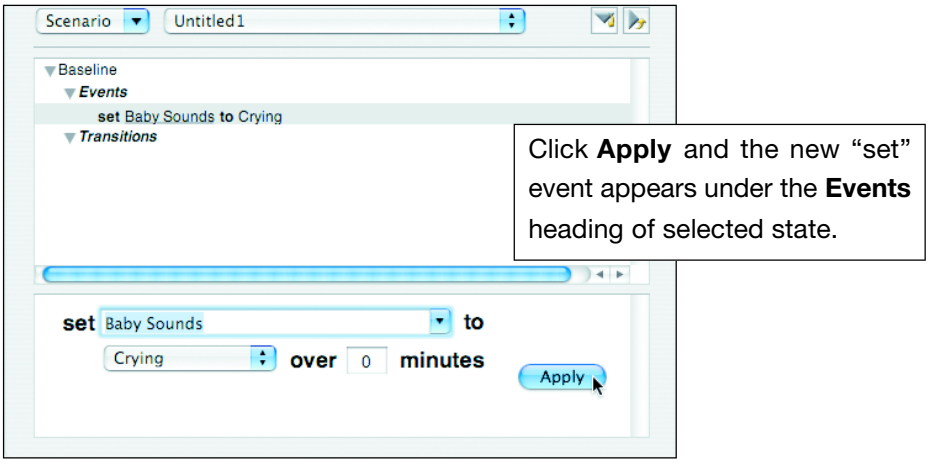
Generally, the default value for the parameter appears in the value field on the second line.

5. Depending on the nature of the parameter, change the value field by entering a new value or by selecting a value from a pull-down list.



Selecting a Value for the Parameter

6. Once the correct value is selected or entered, click the **Apply** button (or press the keyboard's **Enter** key).



Setting the Parameter Values

The new "set" event appears under the **Events** heading of selected state.

7. (OPTIONAL for ONSET values) If the parameter is numerical and is to be onset over time, complete the final field in the panel by entering a decimal value for minutes. (e.g. 0.5 is equivalent to 30 seconds.)

Selecting an Onset Value for the Parameter

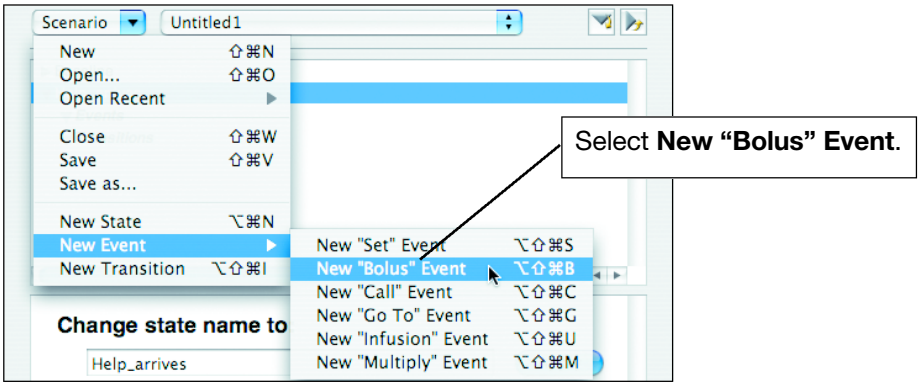
8. (OPTIONAL for ONSET values) Click **Apply** (or press the keyboard's **Enter** key).

"Bolus" Events

A "bolus" event is used to administer a drug bolus within the scenario. For example, the event **give bolus of epinephrine 80 mcg** in an active state automatically administers 80 mcg of epinephrine to the patient, irrespective of any user input or the patient's physiology. The effects of the drug are not removed until the patient is stopped or until additional physiological changes have reversed their influence.

To add a "bolus" event:

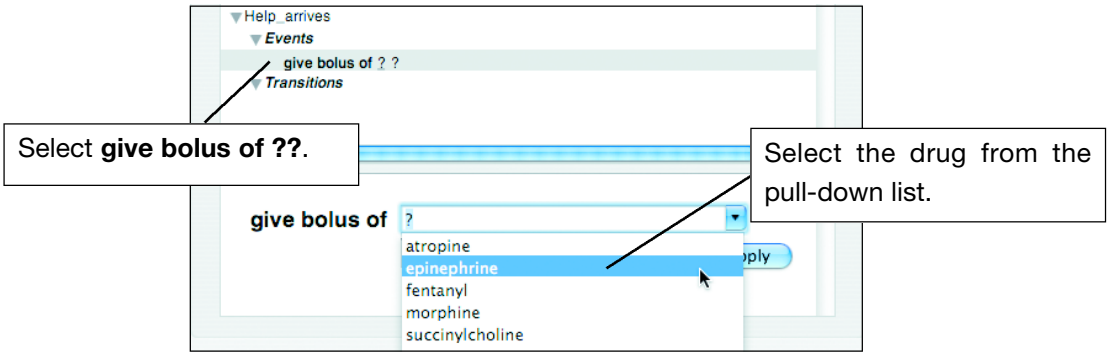
1. Select the appropriate state.
2. Choose **New "Bolus" Event** from the **New Event** option of the **Scenario** menu.



Selecting a New "Bolus" Event

The phrase **give bolus of ??** appears beneath the **Events** heading of the selected state.

3. Select **give bolus of ??**. The lower panel changes to display two fields beginning with the **give bolus of** field.

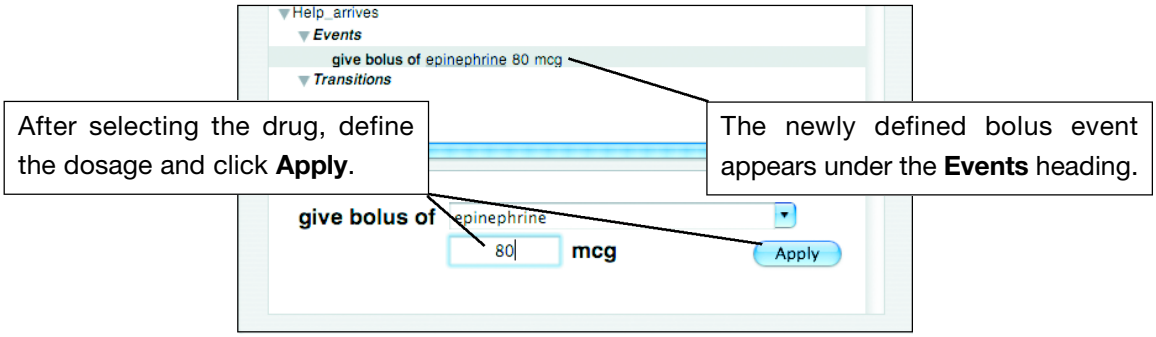


Selecting the Drug for the Bolus Event

4. Using the pull-down list, select the appropriate drug from the list and complete the **give bolus of** field.

Depending on the drug selected, the second field displays a measurement of either **mg** on **mcg** (milligrams or micrograms).

5. Highlight the **?** in the measurement field enter the bolus dose (e.g. 80 **mcg**).



Entering and Applying the Bolus Dose

6. Click **Apply.**

The new "bolus" event appears under the **Events** heading of selected state.

"Call" Events

A "call" event includes the events and transitions of one state within another state. In other words, a **call State B** event added to State A makes the events and transitions of State B a part (or subroutine) of State A. In this way, the use of a "call" event allows states to be used multiple times without the necessity of redefining their events and transitions.

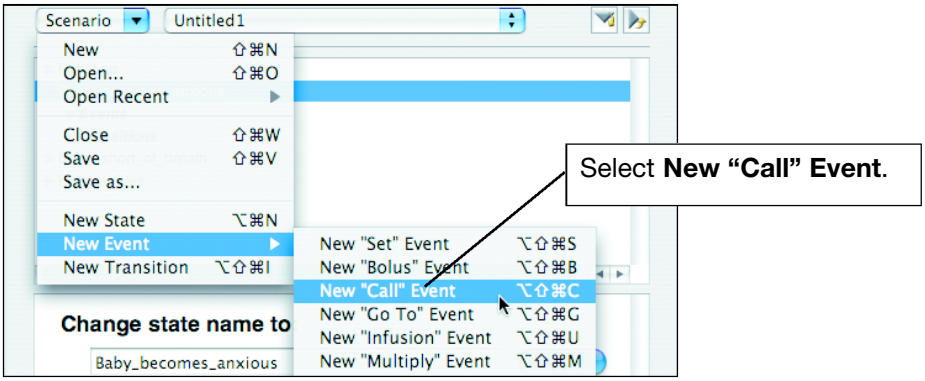
For example, in a scenario where the same three events are repeated in multiple states, a state named "Do Three Things" can be used to define those three events, so that this state can be subsequently called to be included in other states when appropriate.

A "call" event only works within one scenario and only works to call states.

To add a "call" event:

1. Select the appropriate state.

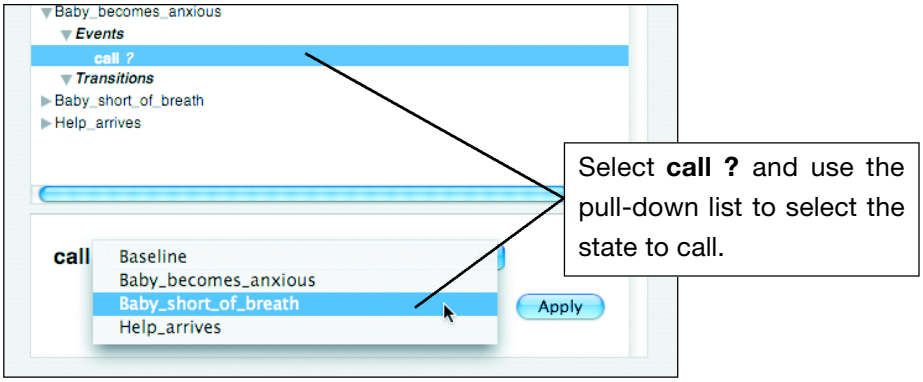
2. Choose **New "Call" Event** from the **New Event** option of the **Scenario** menu.



Selecting a New "Call" Event

The phrase **call ?** appears beneath the **Events** heading of the selected state.

3. Select **call ?**. The lower panel changes to display the **call** field.

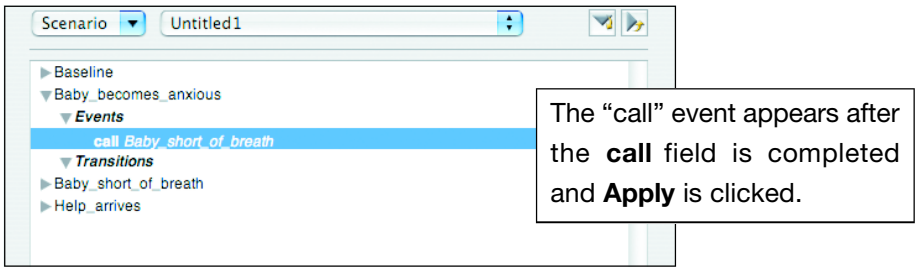


Selecting a State to Call

4. Using the pull-down list, select the appropriate state from the list to complete the **call** field.

5. Click **Apply.**

The new "call"event appears under the **Events** heading of selected state.



A "Call" Event

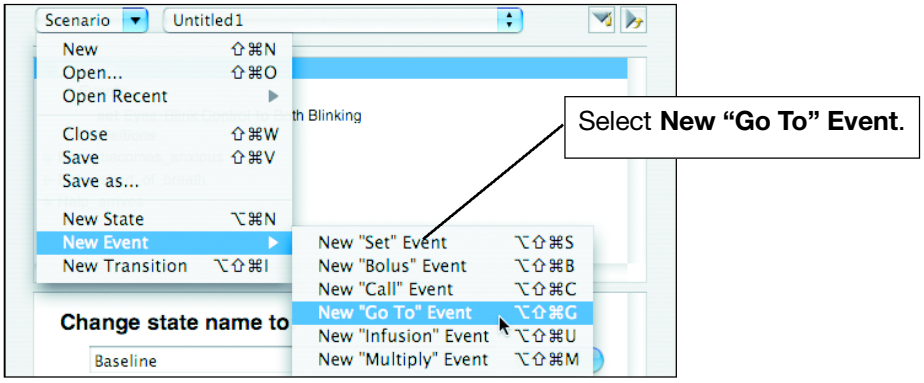
"Go To" Events

A "go to" event moves the scenario automatically from one state to another state. In other words, instead of navigating manually between states using the **Next** and **Go to** buttons on the Scenario Player, the instructor can design the scenario to move to from state to state without additional involvement. However, the use of a "go to" event advances the scenario without any modifications, so interventions have no effect until this movement is complete.

A "go to" event only works within one scenario and only works to move to another state. Because a "go to" event moves the scenario to a different state, no other events listed after the "go to" event take effect.

To add a "go to" event:

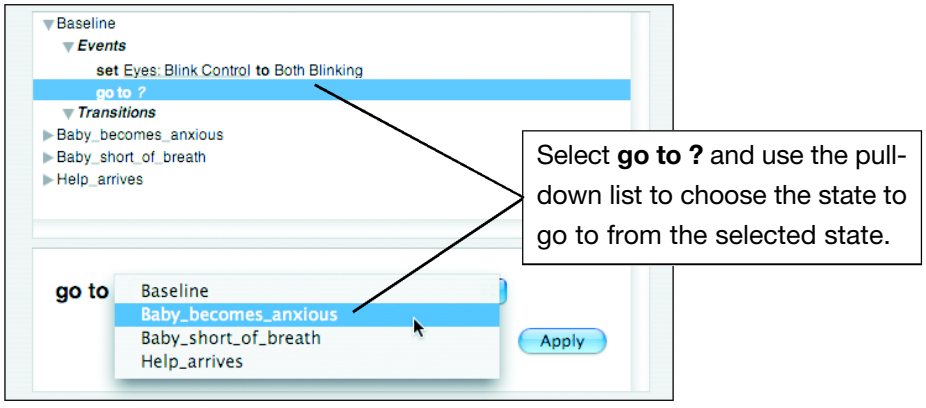
1. Select the appropriate state.
2. Choose **New "Go To" Event** from the **New Event** option of the **Scenario** menu.



Selecting a New "Go To" Event

The phrase **go to ?** appears beneath the **Events** heading of the selected state.

3. Select **go to ?**. The lower panel changes to display the **go to** field.

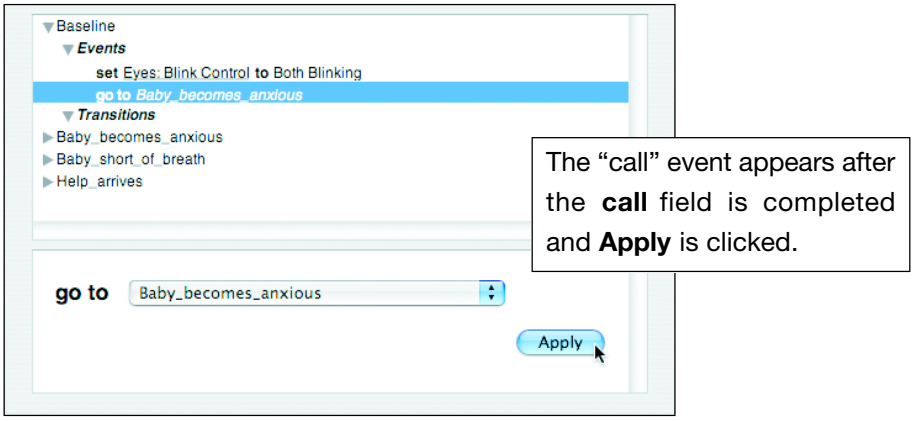


Choosing a State to go to from the Selected State

4. Using the pull-down list, select the appropriate state from the list to complete the **go to** field.

5. Click **Apply.**

The new “go to”event appears under the **Events** heading of selected state.



A “Go To” Event

“Infusion” Events

An “infusion” event is used to administer a drug infusion (or to stop a drug infusion) within the scenario. Once an infusion is administered, it continues to run until stopped either through an additional event in the scenario or user intervention. Infusions are set at an infused rate (mcg/min) or as a normalized infusion (mcg/kg/min).

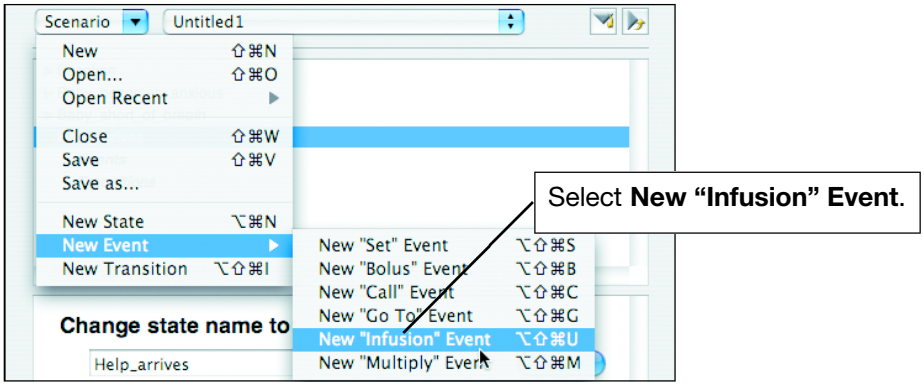
For example, the event **infuse epinephrine at 0.8 mcg/kg/min** starts a 0.8 mcg/kg/min infusion of epinephrine, irrespective of any user input or the patient’s physiology.

The effects of the drug are not removed until the patient is stopped or until additional physiological changes have reversed their influence.

To add an “infusion” event:

1. Select the appropriate state.

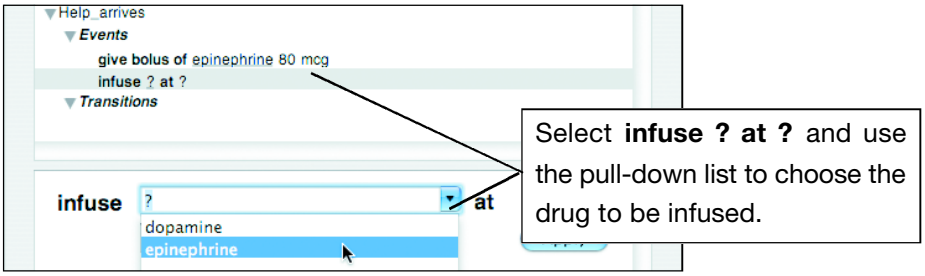
2. Choose **New "Infusion" Event** from the **New Event** option of the **Scenario** menu.



Selecting a New "Infusion" Event

The phrase **infuse ? at ?** appears beneath the **Events** heading of the selected state.

3. Select **infuse ? at ?**. The lower panel changes to display two fields for entering the drug name and the rate of dosage.

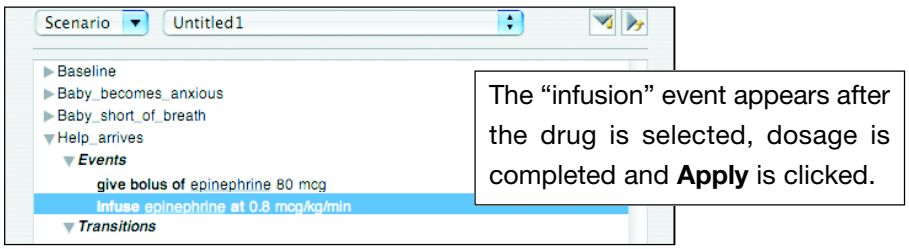


Choosing the Drug to be Infused

4. Using the pull-down list, select the appropriate drug from the list to complete the **infuse** field.

5. Complete the infusion dosage by highlighting the **?** in the dosage field and selecting a rate of infusion (i.e. **mcg/min** or **mcg/kg/min**) from the measurement pull-down list.

6. Click **Apply.**



An "Infusion" Event

The new "infusion" event appears under the **Events** heading of selected state.

"Multiply" Events

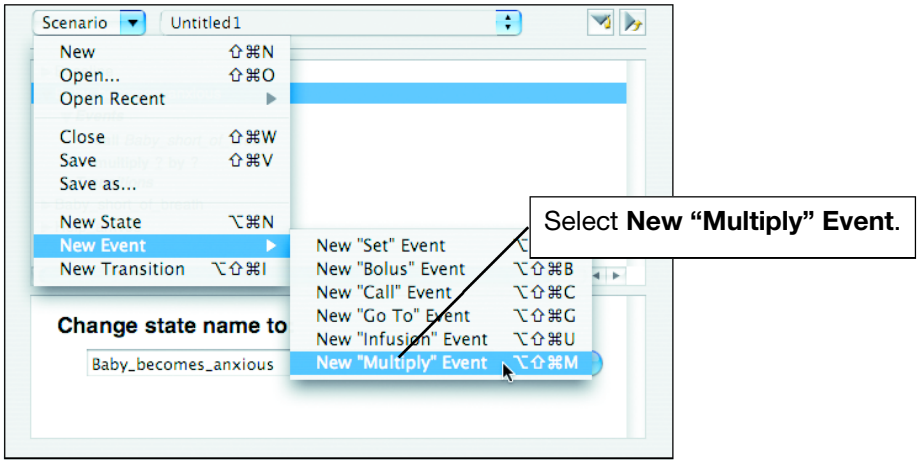
A "multiply" event is used to apply a factor to a numerical parameter that increases or decreases the existing value of that parameter. Unlike a "set" event, which can multiply the default value of a numerical parameter, the "multiply" event factors against the patient's current physiological values.

For example, the event **multiply Heart Rate Factor by 1.5 over 1 minute(s)** changes the heart rate from its current value to a value 1.5 times greater over the course of a minute. On the other hand, the event **multiply Heart Rate Factor by 0.5 over 1 minute(s)** reduces the current heart rate in half over that same time period. (In contrast, setting the Heart Rate Factor of 1.5 over 1 minute establishes a heart rate 1.5 times the patient's default value and NOT the current value.)

As shown the examples above, the "multiply" event can have an "onset" time, thereby allowing for smoother hemodynamic or respiratory changes. Only when the onset of the value has completed can the instructor manually change the parameter's values.

To add a "multiply" event:

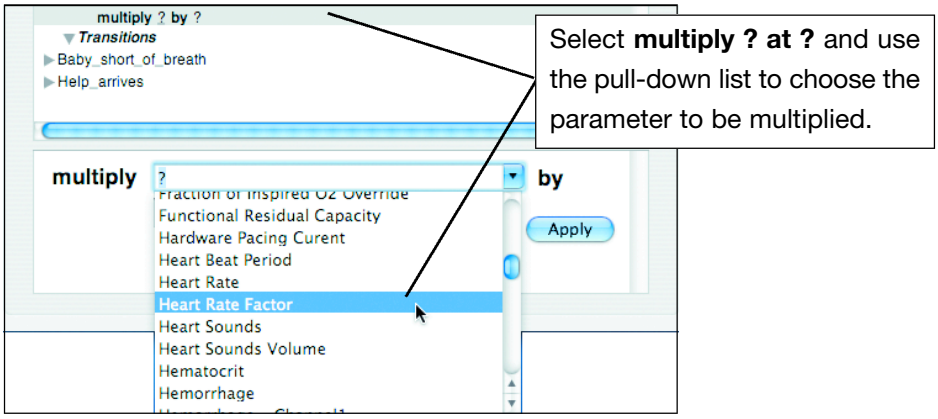
1. Select the appropriate state.
2. Choose **New "Multiply" Event** from the **New Event** option of the **Scenario** menu.



Selecting a New "Multiply" Event

The phrase **multiply ? at ?** appears beneath the **Events** heading of the selected state.

3. Select **multiply ? to ?**. The lower panel changes to display three fields beginning with the **multiply** field.



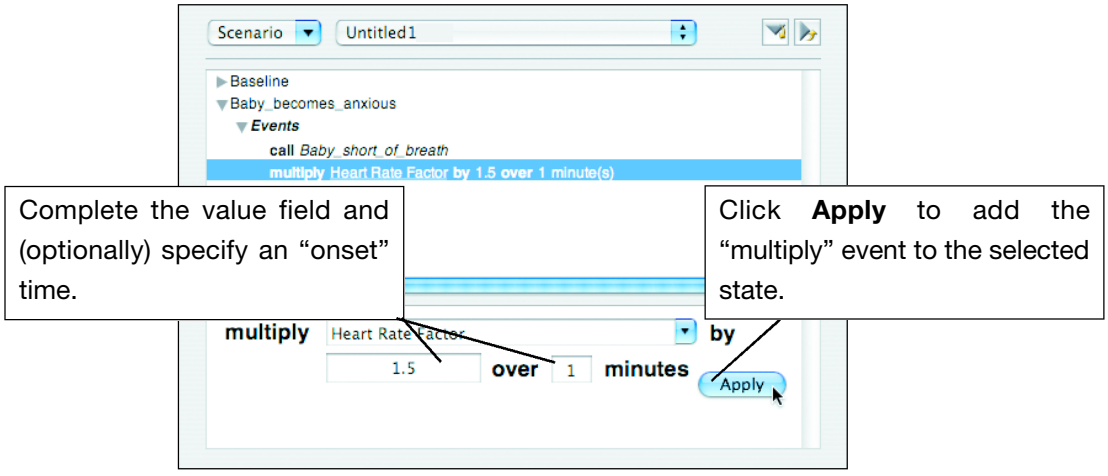
Choosing the Parameter to be Multiplied

4. Using the pull-down list, complete the **multiply** field by selecting the parameter.

Choose only numerical parameters that may be factored. Discrete parameters (e.g. Breath Sounds, Pupil Dilation) are shown in the list, but selecting these parameters may produce unexpected results.

5. Highlight the **?** in the value field enter a factor to increase or decrease the parameter's rate.

6. (OPTIONAL for ONSET values) If the parameter is to be onset over time, complete the final field in the panel by entering a decimal value for **minutes**. (e.g. 0.5 is equivalent to 30 seconds and 2.0 is two minutes.)



Choosing the Parameter to be Multiplied

7. Once the correct value is selected or entered, click the **Apply** button.

The new "multiply event appears under the **Events** heading of selected state.

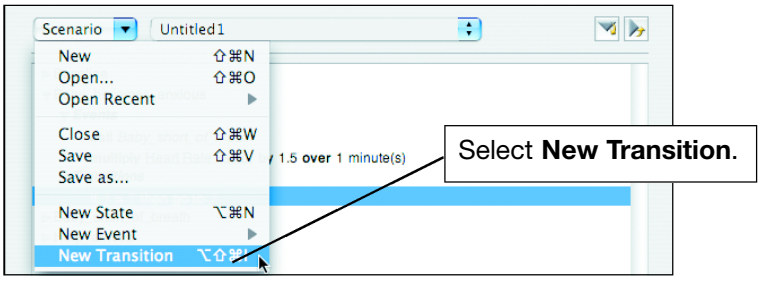
Adding, Editing and Deleting Transitions

Transitions are conditional expressions (if X, then Y) that direct the scenario based on preestablished contingencies. The first part of the expression (the "if" phrase) establishes the contingency while the second part (the "then" phrase) defines the action to be taken. "If" phrases specify relationships (i.e. equals, greater than, less than, etc.) between values for time, drugs, conditions and physiological factors and the command set forth in the "then" phrase.

For example, the transition "**if** Time in State > 60 seconds **then go to** Baby_short_of_breath" moves the scenario to the Baby_short_of_breath state after the specified amount of time, sixty seconds, has passed. Other transitions could offer alternative paths in the scenario by requiring an action to be set in motion by the patient's physiological condition or the cumulative dosage of a drug administered to a patient. In some cases, these actions won't occur because they are triggered only when the condition is met.

To add transitions to a state:

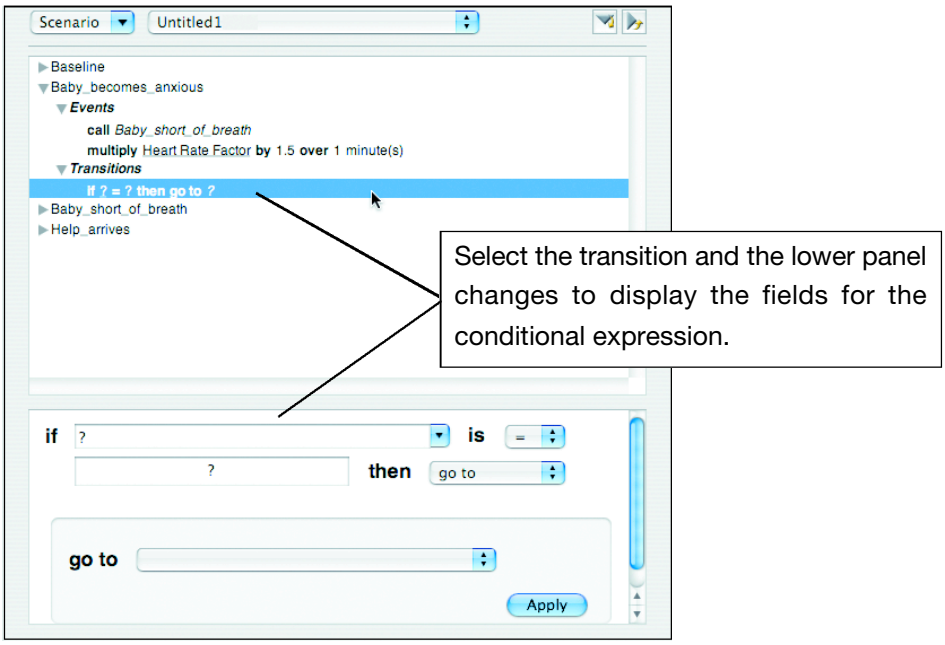
1. Select the state in the Scenario panel.
2. Choose the **New Transition** option from the **Scenario** menu.



Selecting a New Transition

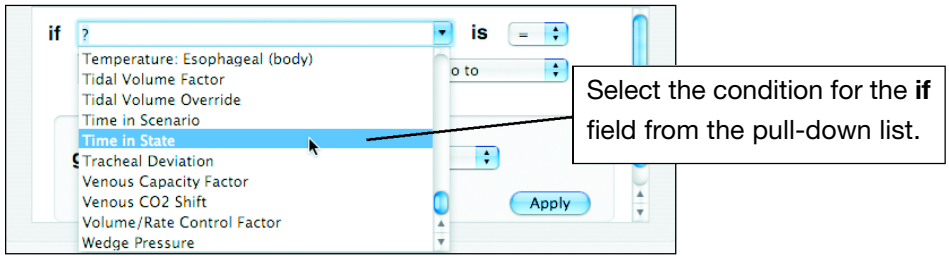
The phrase **if ? = ? then go to ?** appears beneath the **Transitions** heading of the selected state.

3. Select **if ? = ? then go to ?**. The lower panel changes to display five fields beginning with the **if** field.



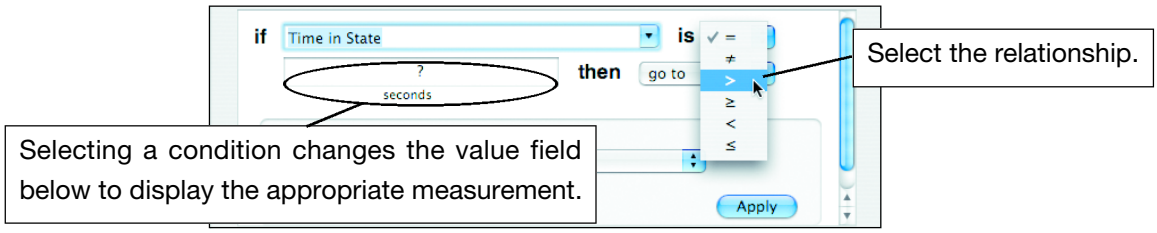
Selecting the Transition

3. Using the pull-down list, select the desired condition from the **If** field.



Selecting the Condition

When a condition is selected, the field below changes to display the measurement for the condition field's value.



Selecting a Relationship for the Condition

4. Select the relationship from the pull-down list in the field to the right of **is**.

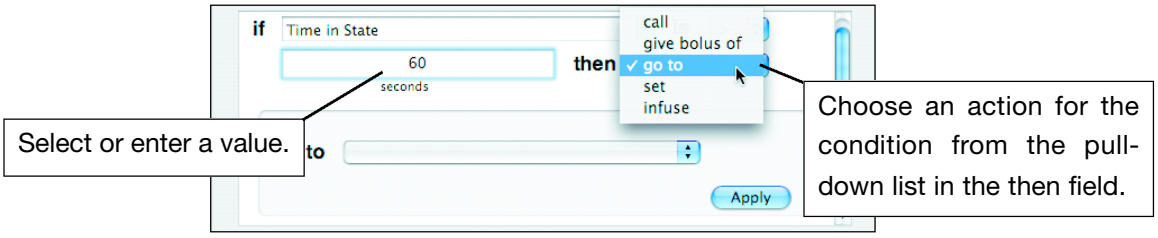
There are six available relationships.

Condition Relationships	
Symbol	**Meaning**
=	equal to
≠	not equal to
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to

5. Enter or select a value for the value box that follows the relationship field.

If a numerical parameter is chosen as the condition, the measurement that appears the value box corresponds to the chosen parameter. If a discrete parameter is selected, a pull-down list with the available parameter settings becomes active.

As conditions in transitions, drug parameters are measured on a per kilogram (of the patient's weight) basis. Transitions are triggered when the administered dose meets or exceeds the entered value (in mcg/kg or mg/kg) times the patient's weight (e.g. 8 kg for Baby Ryan).



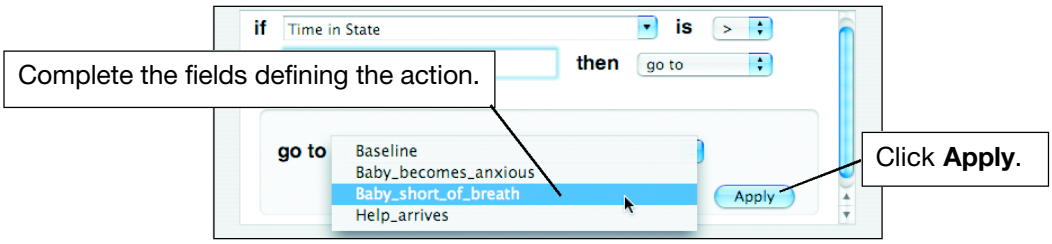
Choosing an Action

6. Complete the **then** field by selecting the action caused by fulfillment of the specified condition.

The fields following the **then** field change to provide the appropriate definition to the chosen action. These fields correspond to the fields used to define events discussed earlier in this User Guide.

Action	Reference Pages
call	See pages 5.21 and 5.22
give bolus of	See pages 5.20 and 5.21
go to	See pages 5.23 and 5.24
set	See pages 5.17 through 5.19
infuse	See pages 5.24 and 5.25

7. Complete the action expression by entering or selecting information for each of the fields.



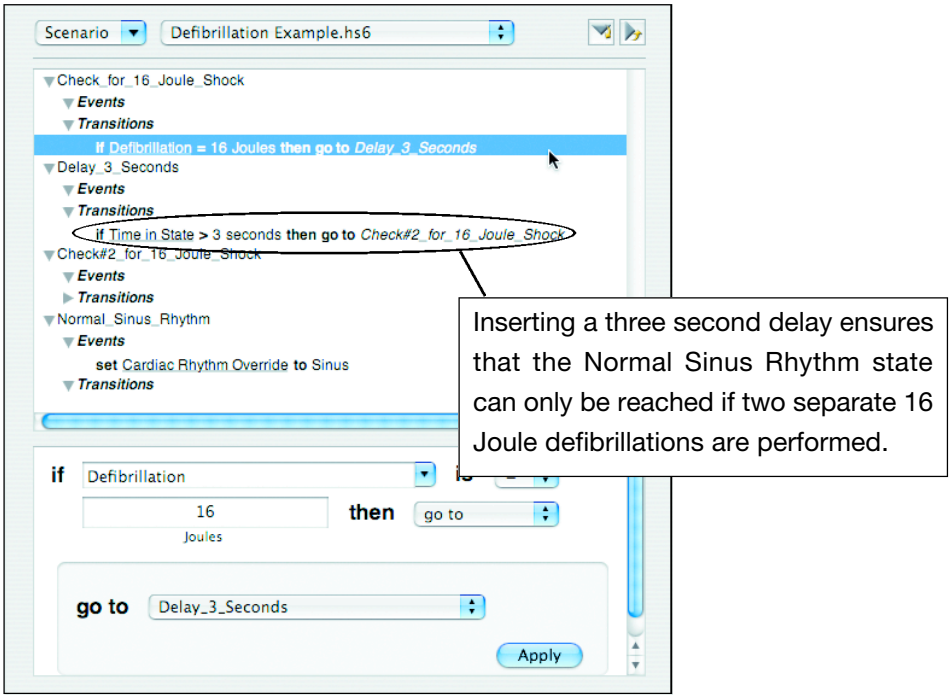
Completing the Transition

8. Click **Apply**.

The new transition appears under the **Transitions** heading of the selected state.

Defibrillation Transitions

When creating automated transitions using the Defibrillation variable, note that after defibrillation the system takes up to three seconds for the values to return from the sensed value (e.g. 16 Joules) to the original value of zero. To prevent unintended successive transitions, a state with a three second delay may be required between successive states that transition on defibrillation.



Sample Transitions for a Defibrillation Scenario

Editing Transitions

Once a transition has been created, it can be modified by selecting the transition in the Scenario panel and altering both the parameters and their values. Transitions are edited in the same manner in which they are created.

Deleting Transitions

To delete a transition, select the transition in the Scenario panel and press the **delete** key. Deletions are irreversible. Always be sure that the transition is not needed before performing the delete function.

Transitions can also be deleted by selecting them and then selecting the **Clear** option from the **Edit** menu.

Changing the Location of Events and Transitions

Events and transitions can be moved within the scenario by using either a drag and drop method or the **Cut** and **Paste** commands. (For a review of dragging, See **Dragging** on Page 3.5.)

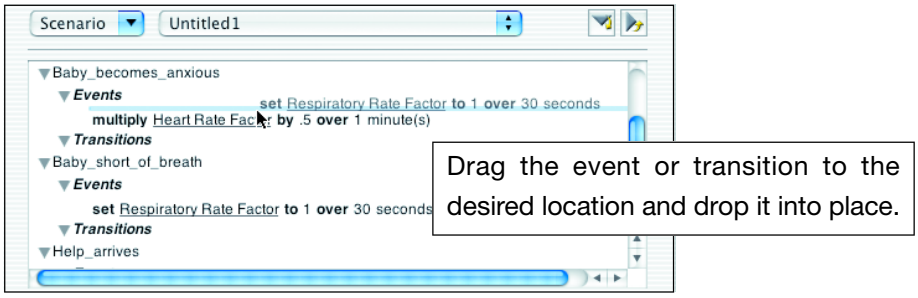
Within a state, events occur simultaneously regardless of order except in the cases of “call” or “go to” events. When a “call” event occurs, the called state’s events take place prior to any subsequent events in the original state. Whenever a “go to” event occurs, the scenario shifts to the “go to” state and no further events are run from the original state.

Transitions occur only when their conditions are met.

Events and transitions can be moved to correct any problems with their original locations.

To drag an event or a transition to a different location:

1. Click on the event or transition and hold the mouse button down.
2. Drag the event or transition to the new location. (An indicator line appears as the event or transition name is dragged past possible locations.)



Dragging an Event to a New Location

3. Release the mouse button, dropping the event or transition into the desired location.

To cut and paste an event or transition into a different location:

1. Select the event or transition.
2. Choose the **Cut** option from the **Edit** menu [or use the Command ( ) + **X** shortcut keys]. The event or transition disappears from its original location.
3. Select the new state where the event or transition will be located.
4. Choose the **Paste** option from the **Edit** menu [or use the Command ( ) + **V** shortcut keys].

Copying Events and Transitions

Events and transitions can be copied and pasted within any state of the scenario by using the **Copy** and **Paste** commands.

To copy and paste an event or transition into another state in the scenario:

1. Select the event or transition. (Only one event or transition can be selected at a time.)
2. Choose the **Copy** option from the **Edit** menu [or use the Command ( ) + **C** shortcut keys]. The event or transition is copied onto the unseen clipboard.
3. Select the new state where the event or transition will be located.
4. Choose the **Paste** option from the **Edit** menu [or use the Command ( ) + **V** shortcut keys]. If needed, the newly copied event or scenario can now be edited.

Using the same method, an event or transition can also be copied and pasted into a different scenario.

To copy and paste an event or transition into another scenario:

1. Select the event or transition. (Only one event or transition can be selected at a time.)
2. Choose the **Copy** option from the **Edit** menu [or use the Command ( ) + **C** shortcut keys]. The event or transition is copied onto the unseen clipboard.
3. Open the second scenario using the **Open** or **Open Recent** options from the **Scenario** menu.
4. Select the state in the second scenario where the event or transition will be located.
5. Choose the **Paste** option from the **Edit** menu [or use the Command ( ) + **V** shortcut keys]. If needed, the newly copied event or scenario can now be edited.

Saving Scenarios

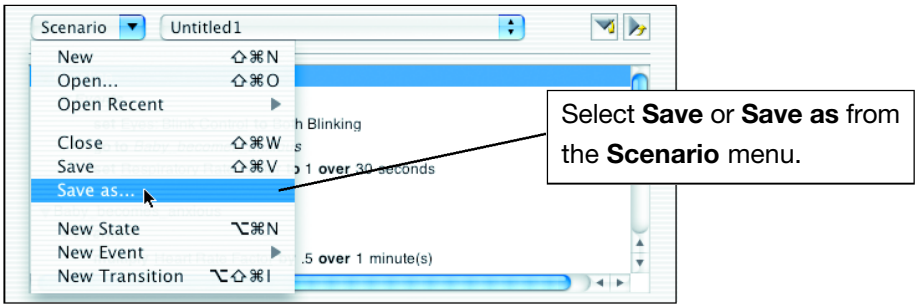
To use the scenario with any patient the scenario file must be named and saved.

Modified preconfigured files must be renamed before they can be saved. Renamed preconfigured scenarios and user-created scenarios can be overwritten, so multiple saves can be performed on those scenarios as changes are made. Saving a scenario file removes the previous version of that scenario.

Initially, new scenarios appear in sequence as **Untitled** files (e.g. **Untitled1** or **Untitled2**).

To save a scenario:

1. Select the **Save** [or use the **Shift** + Command ( ) + **V** shortcut keys] or the **Save as** option from the **Scenario** menu. When saving a preconfigured file, only the **Save as** option functions because the file must be renamed.



Selecting Save As

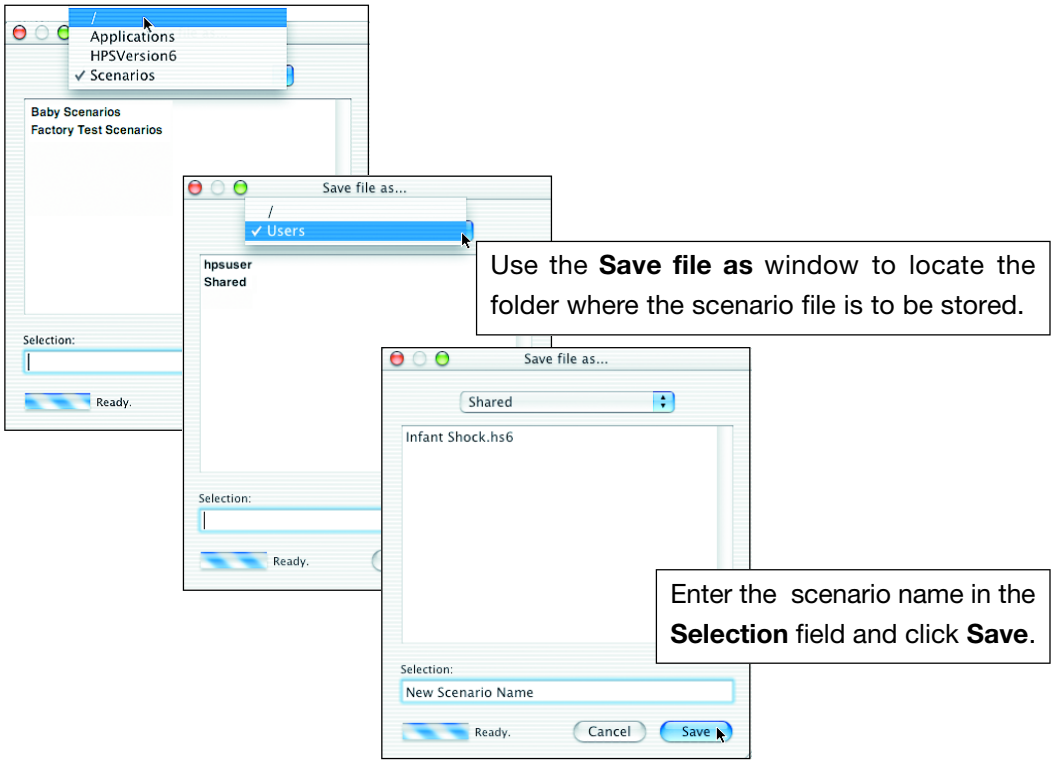
Named scenario files are saved automatically with the **Save** option.

New, unnamed scenario files that are saved or any files saved using the **Save as** option activate the **Save file as** navigational window.

2. Navigate to the location in the directory where the scenario files are to be stored (the /Users/Shared folder).

3. Enter the name for the scenario in the **Selection** field.

The full file path for a scenario or patient is limited to a maximum of 104 characters. For example: /Users/Shared/subdirectory1/subdirectory2/reallygoshdanglongpatientorscenariofilename



Navigating to the Scenario File's Folder

4. Click **Save**.

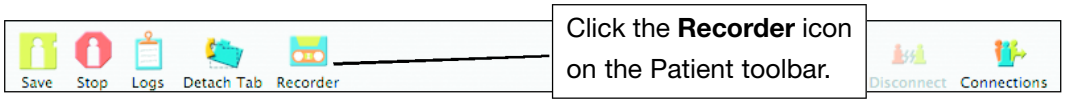
The scenario file is now available to all users with access to the folder where the file was saved.

Using the Event Recorder

The **Event Recorder** records parameter changes made to the active patient. These recorded changes can subsequently be added to a scenario as events. By observing the physiological changes to the patient, modifications to the parameter values can be made using the **Event Recorder** prior to adding those events to the scenario.

To use the **Event Recorder**:

1. Open the **Event Recorder** by clicking the **Recorder** icon on the Patient toolbar.

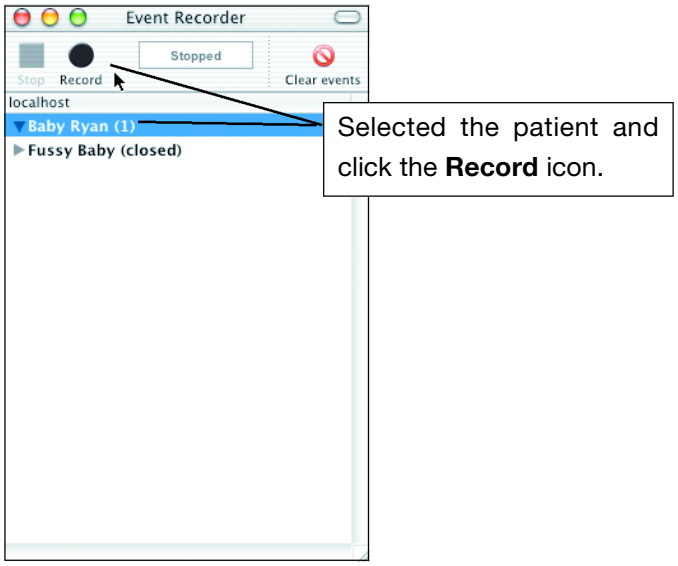


Opening the Event Recorder

The **Event Recorder** opens as a separate window, displaying a list of the names of all the patient files opened during the session. Patient files that have been closed are included in this list.

By default, the status field shows that the **Event Recorder** is **Stopped**.

2. Select the active patient whose events are to be recorded.



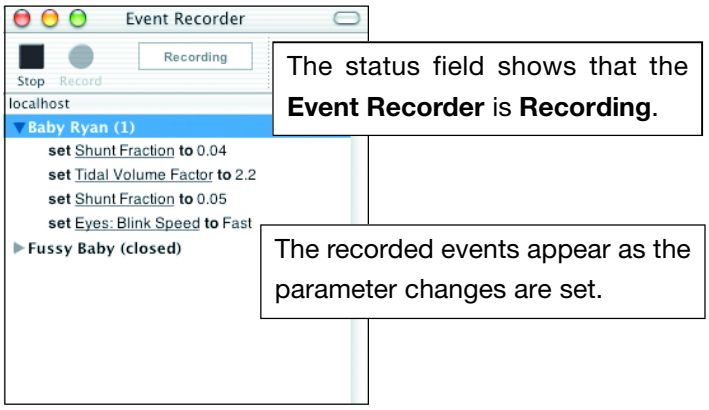
Starting to Record

3. Click the **Record** icon.

The status field shows that the **Event Recorder** is **Recording**.

4. Set the new parameters, observing the physiological changes in the patient.

Parameters are set using the **Condition**, **Drugs**, **Fluids**, **Cardiovascular,** and **Respiratory** tabs, discussed later in this section.



Recording Events

Reset the parameters until the desired physiology is achieved.

As an example, the **Event Recorder** shown below displays the **Shunt Fraction** and **Tidal Volume Factor** parameters found in the **Respiratory Control** section beneath the **Respiratory** tab and the **Eyes: Blink Speed** parameter found in the **Assessment** section of the **Condition** tab.

The **Shunt Fraction** parameter has been reset in this example (from 0.04 to 0.05).

Managing Events in the Event Recorder

Events and closed patient files can be deleted from the **Event Recorder**.

To remove an event, select the event and either press the **delete** key or click the **Clear** icon. To clear all the events from an active patient, select the patient file and either press the **delete** key or click the **Clear Events** icon. To remove a closed patient file (and all its events), select the patient file and either press the **delete** key or click the **Remove** icon.

To stop recording events, click the **Stop** icon.

Events recorded in the **Event Recorder** cannot be saved unless moved to a scenario. (See **Moving Recorded Events to a Scenario** below.) Once the Event Recorder is closed, its events are no longer available.

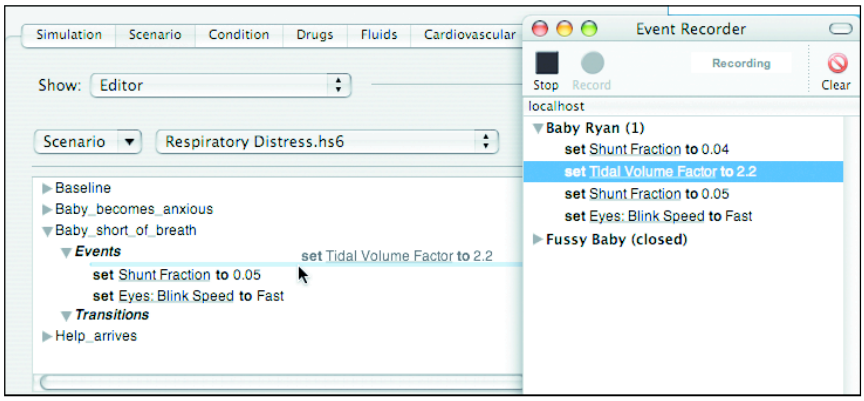
To close the **Event Recorder**, click the red button in upper left-hand corner of the window or, with the **Event Recorder** active, choose the **Close Window** option from the **Window** menu.

Copying Recorded Events to a Scenario

Recorded events can be copied from the **Event Recorder** to a scenario in the Scenario Editor by using either a drag and drop method or the **Copy** and **Paste** commands. (For a review of dragging, See **Dragging** on Page 3.5.)

To copy a recorded event to a scenario using drag and drop:

1. Select the event to be copied in the **Event Recorder**, holding down the mouse button.
2. Drag the event to its new location in the scenario. A blue line appears to indicate where the event is being placed.



Dragging a Recorded Event to a Scenario

3. Release the mouse button. The event is now in the scenario.

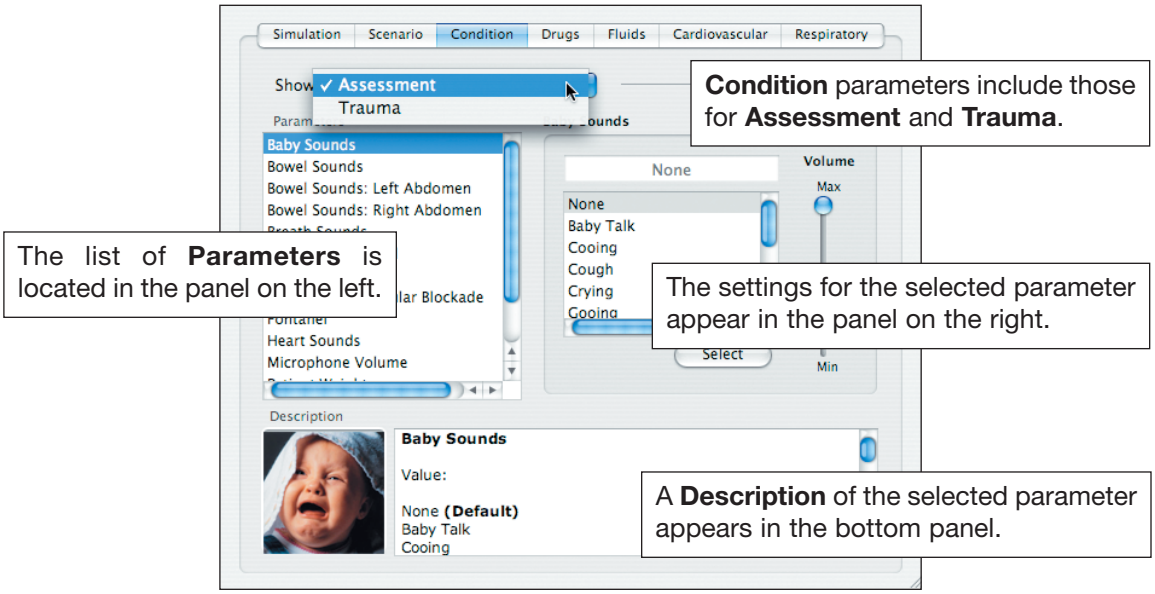
To copy a recorded event to a scenario using the **Copy** and **Paste** commands:

1. Select the event to be moved in the **Event Recorder**.
2. Choose the **Copy** option from the HPS **Edit** menu [or use the Command ( ) + **C** shortcut keys]. The event is copied onto the unseen clipboard.
3. Select the state in the scenario where the event will be located.
4. Choose the **Paste** option from the HPS **Edit** menu [or use the Command ( ) + **V** shortcut keys]. If needed, the newly copied event can now be edited.

The Condition Tab

Selecting the **Condition** tab opens a window that provides a means of changing parameter settings that control patient conditions related to assessment and trauma.

By default, **Assessment** is selected in the **Show** pull-down menu located above a panel with a list of **Parameters** and a panel with settings for those parameters. At the bottom of the window is a **Description** of the selected parameter.



The Condition Tab

Each parameter has settings specifically designed to accurately and realistically affect the infant patient's physiology.

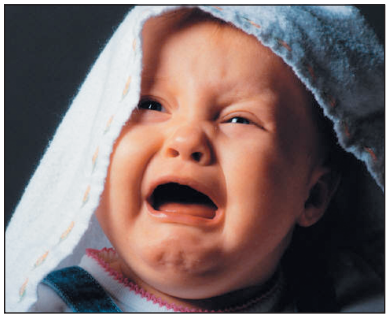
Condition Parameters	
Assessment	**Trauma**
Baby Sounds	Chest Compression Efficacy
Bowel Sounds	Intrapleural Volume
Bowel Sounds: Left Abdomen	Needle Decompression
Bowel Sounds: Right Abdomen	Pericardial Fluid (Acute)
Breath Sounds	
Eyes: Blink Control	
Eyes: Blink Speed	
Fixed Neuromuscular Blockade	
Fontanel	
Heart Sounds	
Microphone Volume	
Patient Weight	
Temperature: Arterial (blood)	
Temperature: Esophageal (body)	

Assessment

Choosing **Assessment** in the **Show** pull-down menu displays the **Parameters** field in the left panel with an alphabetical list of parameters used in evaluating the patient's physiology.

Currently, there are fourteen **Assessment** parameters, each of which is described in the paragraphs below.

Baby Sounds



Value: None **(Default)**
Baby Talk
Cooing
Cough
Crying
Gooing
High Pitched Cry
Screaming
Sneezing

Baby sounds are selected using this parameter. The sounds are played in a continuous loop until unselected. The volume control slider is used to increase or decrease the baby sound volume.

Bowel Sounds

Value: None
Normal **(Default)**
Hyperactive
Hypoactive

Normal and abnormal bowel sounds are selected using this parameter. Sounds are played in a continuous loop on both the left and right side of the abdomen. The volume control slider is used to increase or decrease the bowel sound volume.

Bowel Sounds: Left Abdomen

Value: Enabled **(Default)**
Disabled

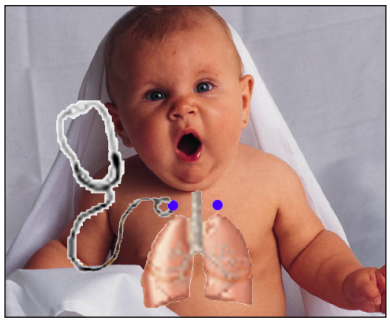
Bowel Sounds Left Abdomen is used to enable or disable the playing of bowel sounds on the left side of the abdomen.

Bowel Sounds: Right Abdomen

Value: Enabled **(Default)**
Disabled

Bowel Sounds Left Abdomen is used to enable or disable the playing of bowel sounds on the left side of the abdomen.

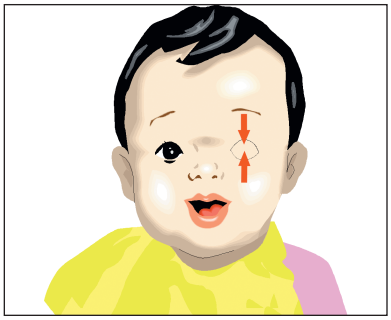
Breath Sounds



Value: Normal **(Default)**
Biphasic Wheeze
Bronchovesicular
Crackles
Prolongation
Rhonchi
Stridor
Wheeze

Normal and abnormal breath sounds are selected using this parameter. Breath sounds are independently synchronized with ventilation of the left and right lungs. The volume control slider is used to increase or decrease the breath sound volume.

Eyes: Blink Control



Value: Automatic **(Default)**
Eyes closed
Both blinking
Left blinking
Right blinking

This parameter is used to control eyelid blinking, with a blink rate specified by the **Eyes: Blink Speed** parameter. By default, eyelid blinking is automatically controlled, but can be overridden by the instructor.

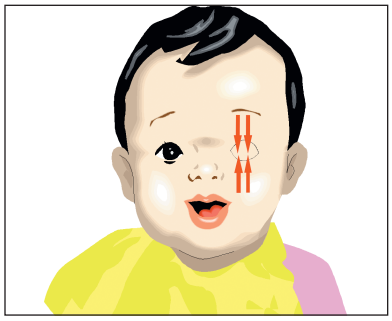
In **Automatic** mode, the eyelids are normally blinking. However, the eyelids will automatically close under any of the following conditions:

- Spontaneous Minute Ventilation < 200 ml
- Neuromuscular Blockade > 30%
- S_aO_2 < 70 %

Thus, the eyelids will close in the presence of drugs sufficient to induce cessation of spontaneous breathing. Likewise, non-pulsatile cardiac rhythms (e.g. Coarse and Fine Ventricular Fibrillation, Pulseless Ventricular Tachycardia, Pulseless Electrical Activity (PEA) and Asystole) will result in the eyelids closing. Eyelid blinking will resume when none of the aforementioned conditions are met.

Other settings allow the user to have one or both eyes either blinking or closed and will override the automatic response.

Eyes: Blink Speed



Value: Normal **(Default)**
Slow
Fast

This parameter is used to control the eyelid blinking frequency. Presently, blinking frequency is not linked to the physiological models. However, the response can be scripted using the **Scenario Editor.**

Fixed Neuromuscular Blockade

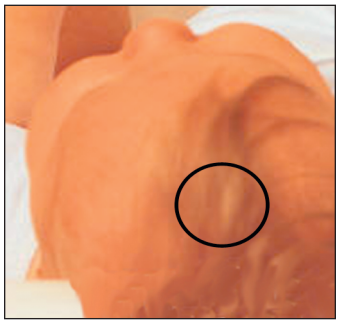
Value: -1, 0 to 100% **Default -1 (model driven)**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The degree of neuromuscular blockade is determined automatically by the pharmacokinetic and pharmacodynamic models based on the neuromuscular blocking agents administered and the time course of their injection. For some educational applications, however, the instructor may wish to set a fixed degree of neuromuscular blockade that remains stable for an indefinite period of time. This can be accomplished using the **Fixed Neuromuscular Blockade** parameter. The default value of -1 instructs the pharmacologic models to determine the degree of neuromuscular blockade based upon the drugs injected and their pharmacologic properties.

When any other positive value is assigned to this parameter, the degree of neuromuscular blockade is set to that level. For example, **Fixed Neuromuscular Blockade 80** causes the simulator to set the degree of neuromuscular blockade to 80%, regardless of the presence (or absence) of neuromuscular blocking drugs. Clinically, the spontaneous tidal volume is markedly reduced.

Fontanel



Value: Normal **(Default)**
Bulging

The anterior fontanel is a fibrous, membrane-covered gap in the bony cranium located at the juncture of the two parietal and two frontal bones. The fontanel should feel flat. When the infant is calm, a bulging fontanel can indicate increased intracranial pressure. When **Bulging** is selected, the anterior fontanel on the mannequin will expand to simulate conditions such as increased intracranial pressure in an infant.

Heart Sounds

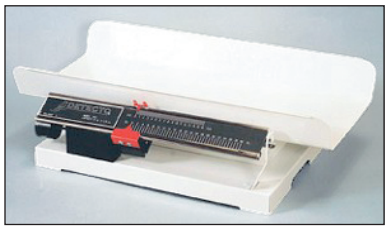
Value: Normal **(Default)**
S_3
S_4
S_3 and S_4
Early Systolic Murmur
Mid Systolic Murmur
Late Systolic Murmur
Holosystolic Murmur
Late Diastolic Murmur

Normal and abnormal heart sounds are selected using this parameter. Sounds are synchronized with the cardiac cycle. The volume control slider is used to increase or decrease the heart sound volume.

Microphone Volume

Microphone Volume is used to adjust the volume of sound coming from the wireless microphone. To increase or decrease the volume of the microphone, and thus the patient's voice, use the volume control slider.

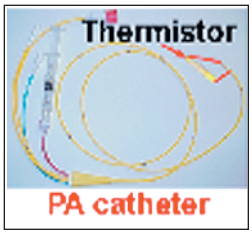
Patient Weight



Value: 2 to 20 kg
Default 8 kg

This parameter sets the patient weight used by the pharmacologic models.

Temperature: Arterial (blood)



Value: 32 to 42 degreesCelsius **Default 37 degrees Celsius**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

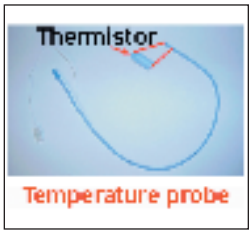
The temperature measured in arterial blood can be set using this parameter and can be displayed on the Waveform Display.

Please note that changes in arterial temperature may alter the shape of the standard oxyhemoglobin dissociation curve as described below:

> Within limits, as temperature increases, so does the amount of oxygen released from hemoglobin; in contrast, as temperature decreases more oxygen remains bound to hemoglobin.
>
> Hyperthermia therefore causes a rightward shift, while hypothermia causes a leftward shift to the standard oxyhemoglobin dissociation curve.

Any other arterial temperature links to the physiologic models can be scripted using the Scenario Editor.

Temperature: Esophageal (body)



Value: 32 to 42 degrees Celsius **Default 36.5 degrees Celsius**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The temperature measured in the esophagus can be set using this parameter and can be displayed on the Waveform Display.

The esophageal temperature is not linked to the physiologic models. However, changes can be scripted using the Scenario Editor.

Trauma

Choosing **Trauma** in the **Show** pull-down menu displays the **Parameters** field in the left panel with an alphabetical list of parameters used in evaluating the patient's physiology.

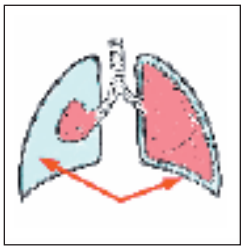
Currently, there are four **Trauma** parameters, each of which is described in the paragraphs below.

Chest Compression Efficacy

Value: 100% **(Default)**
0%

The Chest Compression Efficacy parameter is used to determine the effectiveness of the chest compressions administered by the caregiver. The 100% setting indicates that chest compressions are completely effective, while the 0% setting prevents them from having any effect on intrathoracic pressure.

Intrapleural Volume



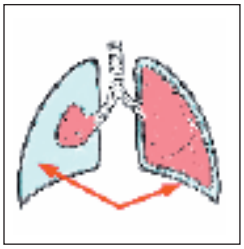
Intrapleural Volume (Left)
Intrapleural Volume (Right)

Value: 0 to 100 ml **Default 0 ml**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

Normally, the visceral and parietal pleural surfaces are closely approximated with virtually no volume in between. The intrapleural volume parameters allow intrapleural volume to accumulate, for example, as happens during pneumothorax, hydrothorax, or hemothorax. Accumulation of a "displacing" volume in the intrapleural space causes compression of the lung tissue because both lung tissue and intrapleural volume are contained within the chest wall. Thus, attempts to inflate the compressed lung are prevented by the relative indistensibility of the chest wall at higher lung volumes.

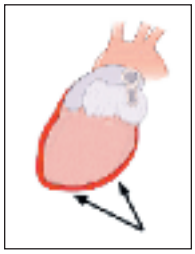
Needle Decompression



Value: Enabled
Disabled **(Default)**

The Needle Decompression parameter is used to activate the needle decompression to relieve a pneumothorax hardware in the mannequin.

Pericardial Fluid (Acute)



Value: 0 to 20 ml **Default 0 ml**

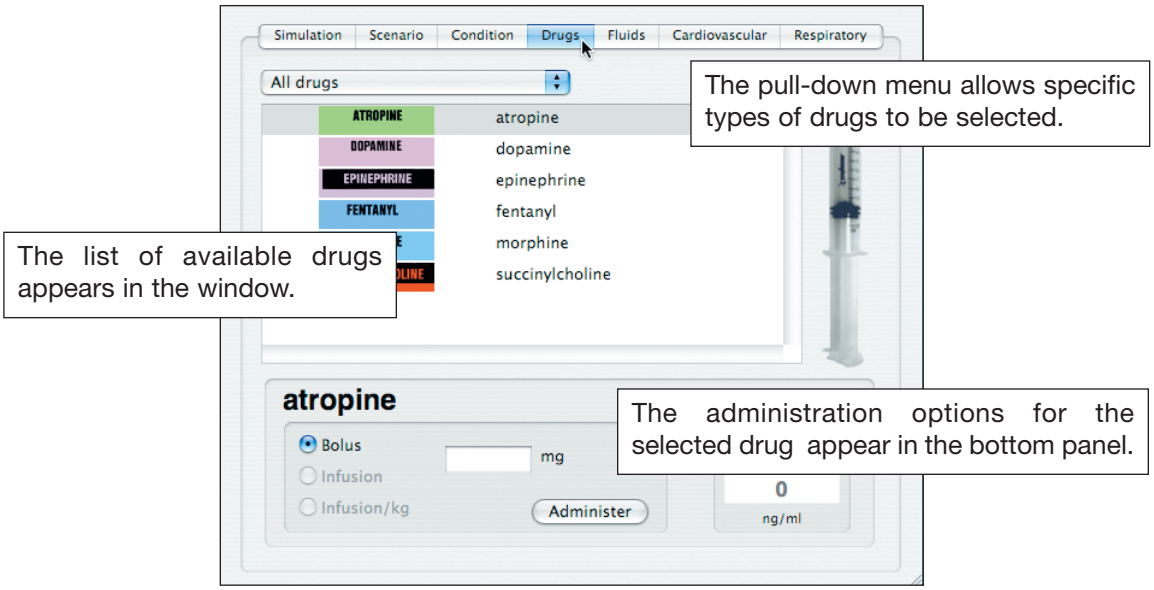
Onset: 0 to 60 minutes **Default 0 minutes**

Pericardial Fluid (Acute) is used to simulate the amount of fluid within the pericardial sac. This parameter may be used to simulate the infant with a cardiac tamponade.

The Drugs Tab

Selecting the **Drugs** tab opens a window that provides a means of administering medications from the Instructor Workstation. Based on normal clinical practices, medications may be given as a bolus, an infusion, or as an infusion based on the patient's weight in kilograms (normalized infusion).

By default, **All drugs** is selected in the pull-down menu located above the window showing the available drugs.



The Drugs Tab

The pull-down menu offers the option of selecting a specific drug category.

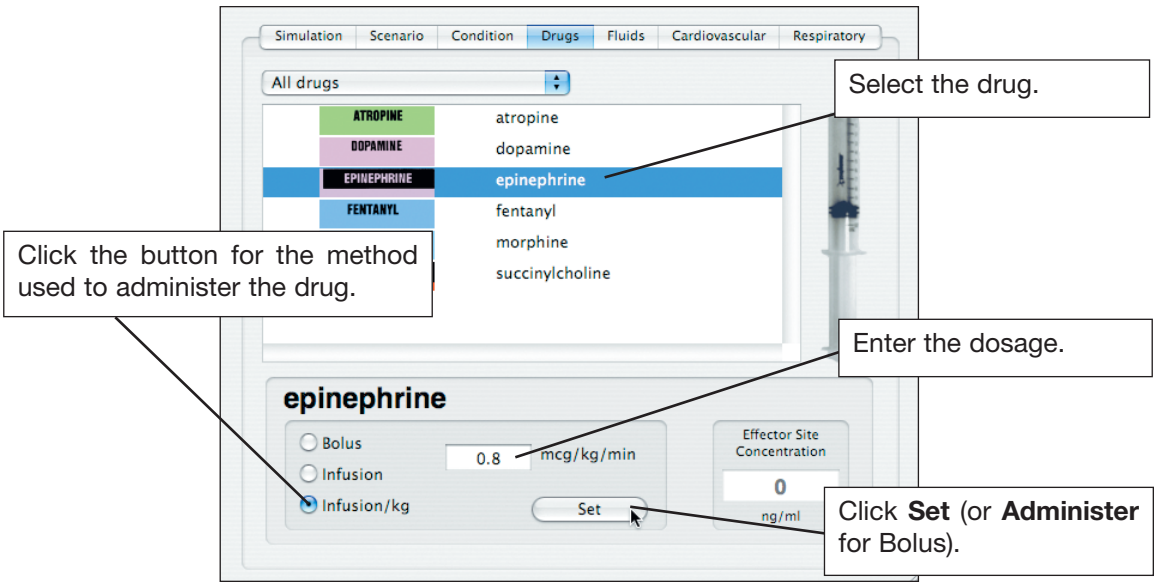
Drug Categories
Narcotics
Neuromuscular Blockers
Cardiovascular
ACLS

Once a drug is selected in the window, the bottom panel displays the settings for administering the selected drug.

Administering Medications

To administer medications:

1. Select the drug. The bottom panel displays that drug's administration settings.



Administering Drugs

2. Click the radio button for the appropriate method of administering the drug. Some drugs may have only one acceptable method.

3. Enter the dosage in the field to the right of the methods. This field will be labeled either **mcg** or **mg** (for bolus), **mcg/kg** (for infusions) or **mcg/min/kg** (for normalized infusions).

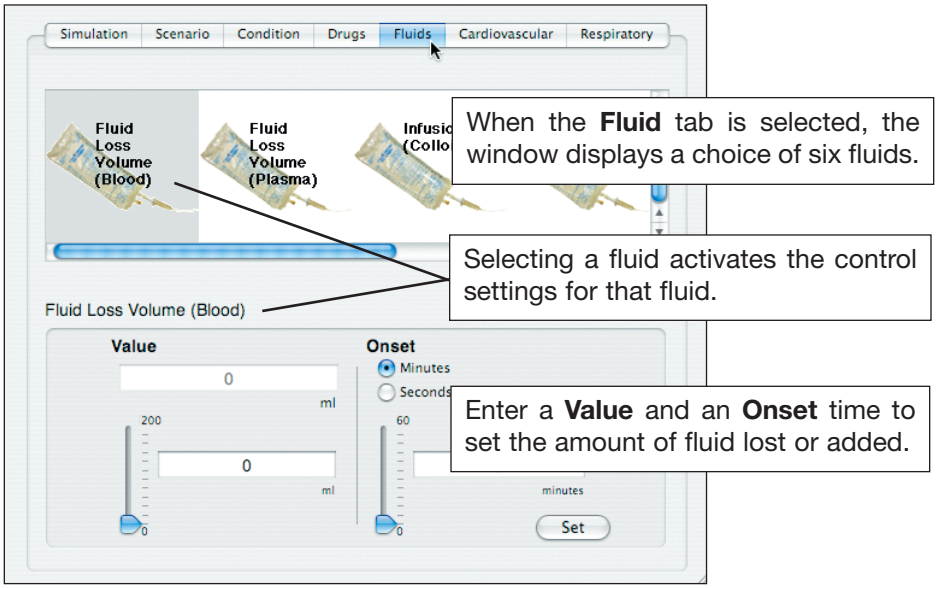
4. Click the **Administer** button to enter a bolus injection or the **Set** button to start an infusion.

Interpreting the Effector Site Concentration

When a drug is administered to a patient, the onset and duration of its effect depend upon the rate of absorption into the bloodstream, distribution to various organs, tissue binding, access to those tissues where the pharmacological effect takes place, interaction with receptor sites, and elimination by various routes. The effect of a drug is modeled by a static relationship between the drug concentration in a hypothetical effector site (of negligible volume) and a measurable effect. Because of the hypothetical nature of the effector site, its concentration is called an "apparent" concentration, and is defined as the plasma concentration in a steady-state situation that results in the same degree of drug effect. This concentration, shown in the lower right-hand panel as **Effector Site Concentration**, is displayed in nanograms per milliliter (ng/ml).

The Fluids Tab

Selecting the **Fluids** tab opens a window that provides a means of controlling the amount of fluid lost by or infused into the patient. The upper panel provides scrollable access to the various fluid parameters and the bottom panels display the controls for entering the amount of fluid to be lost or infused and establishing the time frame during which the fluid loss or infusion will take place.



The Fluids Tab

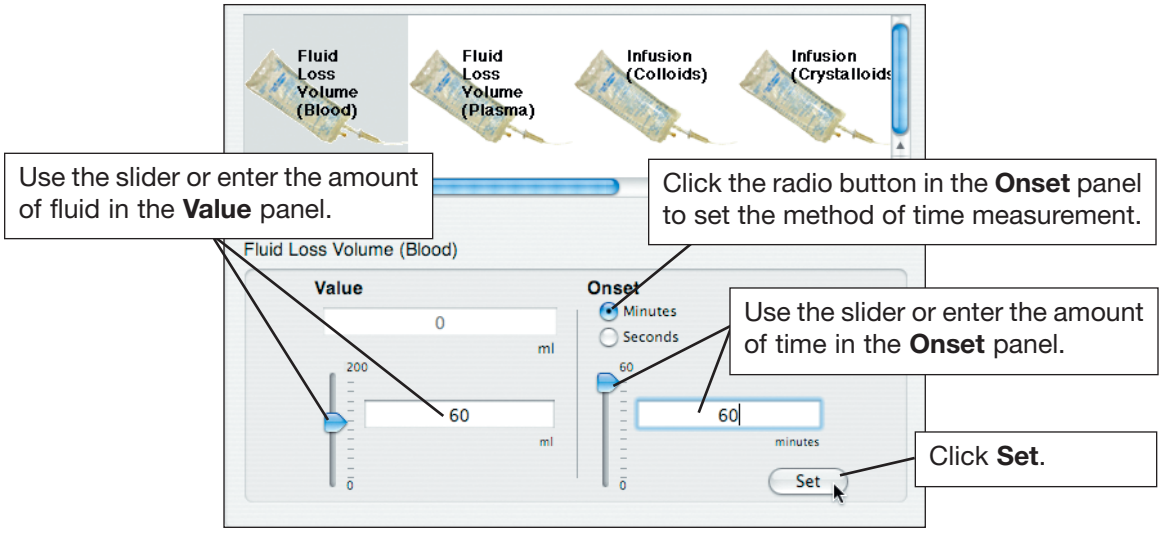
Currently, there are six fluids that can be controlled using the **Fluids** tab.

Fluid Parameters	
Fluid Event	**Use/Effect**
Fluid Loss Volume (Blood)	**Reflects a decrease in total blood volume. "Blood Loss" proportionally decreases both the red blood cell volume and the plasma volume according to the current hematocrit.**
Fluid Loss Volume (Plasma)	**Reflects a decrease in plasma volume. "Fluid Loss" decreases the plasma volume without changing the red blood cell volume. It refers collectively and generically to all fluid losses, including evaporative, transcellular (e.g. ascites, pleural effusion), bowel, and third space fluid losses.**
Infusion (Colloids)	**Reflects an addition to the plasma volume without changing the red blood cell volume. Colloids include modified fluid gelatin starch solutions (pentastartch and hetastarch), dextran and human albumin.**
Infusion (Crystalloids)	**Reflects an addition to the plasma volume without changing the red blood cell volume. The term crystalloid is used to describe salt solutions for infusion, for example, normal saline, dextrose in water and Ringer's Lactate.**
Infusion (Packed Red Blood Cells)	**A preparation of 70% red blood cells and 30% liquid plasma, often administered in severe anemia to restore adequate levels of hemoglobin and red cells without overloading the vascular system with excess fluids.**
Infusion (Whole Blood)	**The term whole blood is used to refer to blood that has not been separated into its various components. It represents a preparation of 40% red blood cells and 60% liquid plasma.**

Controlling Fluids

To control fluids lost or infused:

1. Select the fluid by clicking on the icon in the scrollable window. The bottom panel displays that fluid's control settings.



Setting Fluid Loss or Infusion

2. In the **Value** panel, use the slider to choose a value or enter the value in the field to the right of the slider.
3. In the **Onset** panel, click a radio button to select in Minutes or Seconds that will determine the time measurement for the fluid loss or infusion.
4. Use the slider to choose the amount of time over which the fluid loss or infusion will take place or enter that amount in the field to the right of the slider.
5. Click **Set**.

The amount of fluid lost or infused appears in the **Value** fields as the loss or infusion takes place. This amount increases until the total value is achieved at the end of the onset time.

In the example above, 60 milliliters (mL) of blood loss have been set to occur over 60 minutes. In this scenario, the field beneath **Value** will show an additional milliliter of blood loss each minute until the full 60 minutes have elapsed and a total of 60 milliliters of blood has been lost.

Hematology Model

The physiological model calculates hematocrit values (i.e. percentage of total blood hemoglobin) dynamically and continuously, taking into account blood and fluid losses, as well as the intravenous infusion of fluids such as whole blood, packed red blood cells, colloids, and crystalloids.

Instructors can now create patients with both normal and pathophysiological hematocrit levels. In addition, learners discover how administering various fluids impacts hematocrit, the oxygen-carrying capacity of blood, and the resulting patient response.

The following important assumptions were made in the design of this initial Hematology Model:

Blood is comprised of two components: red blood cells and plasma.

Plasma is comprised of two components: colloid and crystalloid. The term colloid is used to describe substances that generate a clinically significant colloid osmotic pressure, for example, fresh frozen plasma, albumin and hetastarch. The term crystalloid is used to describe salt solutions for infusion, for example, normal saline, dextrose in water and Ringer's Lactate.

The mixing of blood and its various constituents is instantaneous and homogeneous. In other words, one liter of crystalloid administered intravenously equilibrates immediately and homogeneously throughout the entire circulation.

This initial Hematology Model does not yet distinguish between the differing clinical effects of colloids versus crystalloids. For example, osmotic pressures and capillary leakage rates are not taken into account. Likewise, fluid kinetics and how fluids distribute within the circulation, the interstitial, and intracellular spaces are also not presently modeled.

In the Hematology Model, the following model variables, definitions, and relationships have been established:

Red Blood Cell Volume: The volume of red blood cells within the circulation.

Plasma Volume: The volume of plasma within the circulation.

Total Blood Volume: The volume of blood (i.e. Red Blood Cell Volume + Plasma Volume) within the circulation.

Blood Volume Loss: The amount or rate of decrease in the total blood volume. A given amount or rate of blood loss proportionally decreases both the Red Blood Cell Volume and the Plasma Volume according to the current hematocrit.

Plasma Volume Loss: The amount or rate of decrease in the plasma volume. A given amount or rate of plasma loss decreases the plasma volume without changing the red blood cell volume. Plasma Volume Loss refers collectively and generically to all plasma fluid losses, including evaporative, transcellular (e.g. ascites, pleural effusion), bowel and third space losses.

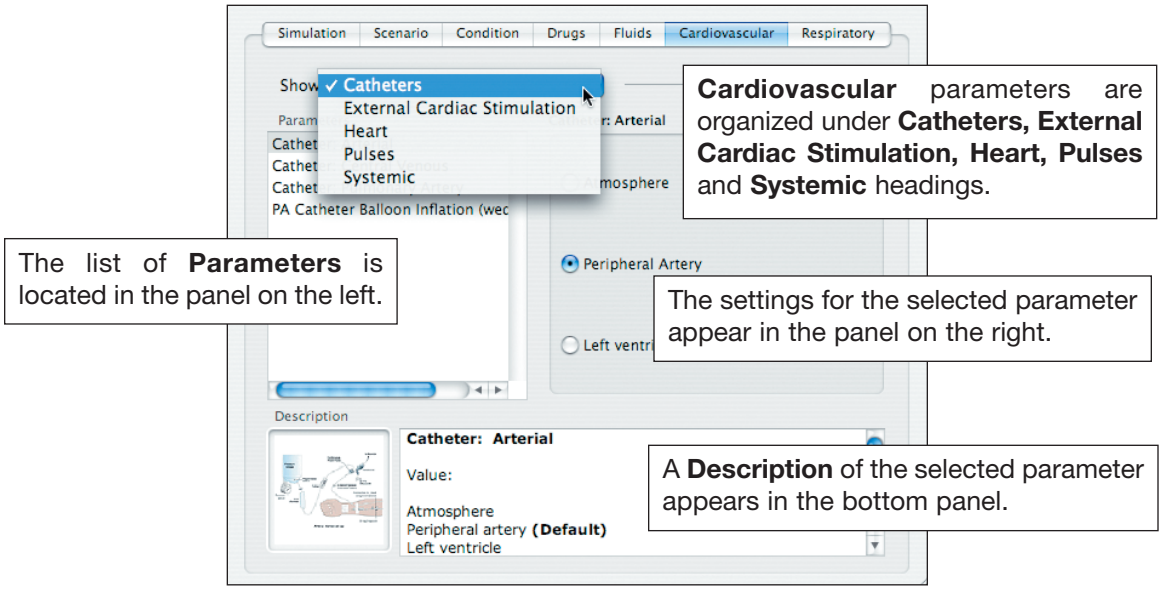
Hematocrit: The ratio of Red Blood Cell Volume to Total Blood Volume, expressed as a percentage.

The Hematology Model is affected by the choices made using the parameters provided by the **Fluids** tab. In the table below, this effect is shown as an increase (↑), decrease (↓) or unchanged.

Effect	Fluid Loss Volume (Blood)	Fluid Loss Volume (Plasma)	Infusion (Colloids)	Infusion (Crystalloids)	Infusion (Packed Red Blood Cells)	Infusion (Whole Blood)
Total Blood Volume	↓	↓	↑	↑	↑	↑
Red Blood Cell Volume	↓	unchanged	unchanged	unchanged	↑	↑
Plasma Volume	↓	↓	↑	↑	↑	↑
Hematocrit	unchanged	↑	↓	↓	↑	unchanged

The Cardiovascular Tab

Selecting the **Cardiovascular** tab opens a window providing a means of changing parameter settings that control patient conditions related to the circulatory system. **Catheters** is selected in the **Show** menu located above the **Parameters** panel and the panel with the settings for those parameters. At the bottom of the window is a **Description** of the selected parameter.



The Condition Tab

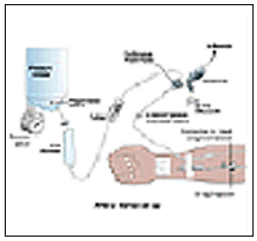
The **Show** menu contains five sub-sections, each with its own set of parameters.

Cardiovascular Parameters				
Catheters	**External Cardiac Stimulation**	**Heart**	**Pulses**	**Systemic**
Catheter: Arterial	Defibrillation	Baroceptor Gain (Cardiac) Factor	Brachial	Baroceptor Gain (Overall) Factor
Catheter: Central Venous	Pacing Capture Threshold	Cardiac Rhythm Override	Femoral	Baroceptor Gain (Peripheral) Factor
Catheter: Pulmonary Artery	Pacing Current	Contractility Factor: Left Ventricle		Baroceptor Maximum Pressure
PA Catheter Balloon Inflation (wedge)	Pacing Rate	Contractility Factor: Right Ventricle		Baroceptor Minimum Pressure
		Fixed Heart Rate		Elastance: Extrathoracic Arteries
		Heart Rate Factor		Elastance: Intrathoracic Arteries
		Heart Sounds		Elastance: Pulmonary Arteries
		Pericardial Fluid (Acute)		Resistance Factor: Pulmonary Vasculature
		Resistance Factor: Aortic Valve		Resistance Factor: Systemic Vasculature
		Resistance Factor: Mitral Valve		Resistance Factor: Venous Return
		Resistance Factor: Pulmonic Valve		Venous Capacity Factor

Catheters

Choosing **Catheters** in the **Show** pull-down menu of the **Cardiovascular** tab displays the **Parameters** field in the left panel with an alphabetical list of parameters used in affecting the patient's physiology.

Catheter: Arterial



Value: Atmosphere
Peripheral artery **(Default)**
Left ventricle

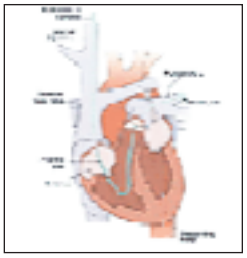
The arterial pressure displayed on the Waveform Display is set using this parameter. A non-pulsatile "zero" pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the arterial pressure waveform if desired (i.e. the beginning of a scenario with an "unmonitored" patient). The **Left ventricle** position is useful for simulating cardiac catheterization procedures, or for demonstrating left ventricular end-diastolic pressure and its relationship to pulmonary artery occlusion ("wedge") and central venous pressure.

Catheter: Central Venous

Value: Atmosphere
Extrathoracic vein
Intrathoracic vein **(Default)**

The venous pressure displayed on the Waveform Display is set using this parameter. A non-pulsatile "zero" pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the central venous pressure waveform if desired (i.e. the beginning of a scenario with an "unmonitored" patient).

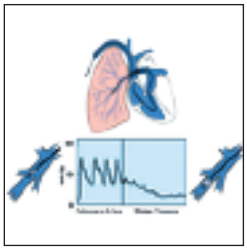
Catheter: Pulmonary Artery



Value: Atmosphere
Intrathoracic vein
Right atrium
Right ventricle
Pulmonary artery **(Default)**

The pulmonary artery pressure displayed on the Waveform Display is set using this parameter. A non-pulsatile “zero” pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the pulmonary arterial pressure waveform if desired (i.e. the beginning of a scenario with an “unmonitored” patient). The pulmonary artery catheter can be “floated” into position by sequencing through the right heart positions. This may also be scripted into a scenario using the Scenario Editor.

Catheter: PA Catheter Balloon Inflation (wedge)



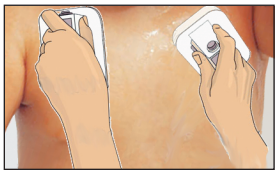
Value: Balloon inflated
Balloon deflated **(Default)**

Inflation of the pulmonary artery catheter balloon is simulated by selecting the **Balloon Inflated** option of the **PA Catheter Balloon Inflation (wedge)** parameter. The appropriate pulmonary artery occlusion or “wedge” waveform is then displayed on the Waveform Display.

External Cardiac Stimulation

Choosing **External Cardiac Stimulation** in the **Show** menu displays the **Parameters** field in the left panel with a list of parameters used to defibrillate or pace the patient from the HPS6 software. Each parameter displays a current value, a slider showing a range of acceptable values and a corresponding field where new values can be entered.

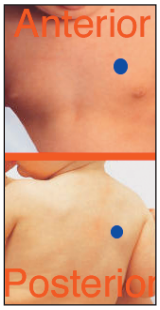
Defibrillation



Value: 0 to 360 Joules
Default 0 Joules

The **Defibrillation** parameter is used to simulate a specified amount of energy discharged via an external cardiac defibrillator. Setting this parameter results in the characteristic spike in ECG, followed by a return to pre-defibrillation rhythm. Defibrillation has no direct effect on the electrical conduction system of the heart; thus cardioversion may be scripted using the Scenario Editor.

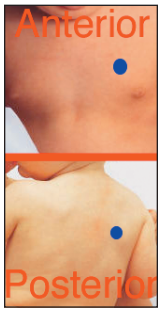
Pacing Capture Threshold



Value: 0 to 200 mA
Default 50 mA

The **Pacing Capture Threshold** parameter determines the minimum pacing current necessary in order to pace the heart via an external cardiac pacer. Also see **Pacing Current.** Pacing current values below the pacing capture threshold will have no effect on the patient's heart rate.

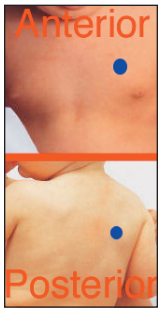
Pacing Current



Value: 0 to 200 mA
Default 0 mA

The **Pacing Current** parameter is used to simulate a specified amount of current discharged via an external cardiac pacer. Setting this parameter results in the characteristic pacing signal on the ECG waveform when the pacing current is at or above the capture threshold. Also see **Pacing Capture Threshold.**

Pacing Rate



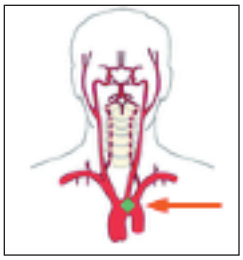
Value: 40 to 170 beats/min
Default 80 beats/min

The **Pacing Rate** parameter determines the cardiac rate (in beats/min) when the pacing current is at or above the pacing capture threshold. Also see **Pacing Current** and **Pacing Capture Threshold**.

Heart

Choosing **Heart** in the **Show** menu displays those parameters used to affect how the patient's heart functions or the ECG displayed on the physiological monitor. Heart parameter values are controlled using either numerical or discrete settings, depending on the parameter.

Baroceptor Gain (Cardiac) Factor

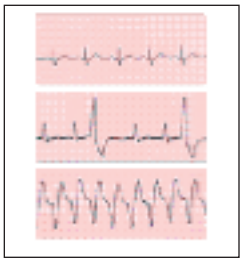


Value: 0 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter selectively adjusts the influence of mean arterial pressure (MAP) on the cardiac effectors (heart rate and contractility). A factor of less than 1 corresponds to baroreflex depression (e.g. less heart rate response to MAP changes). A value greater than 1 leads to a stronger response to MAP changes. Setting Barorecptor gain (cardiac) factor to 0 can simulate the absence of baroreflex control of the heart in a transplant patient. The effect of this factor and the **Baroreceptor Gain (Overall) Factor** is multiplicative.

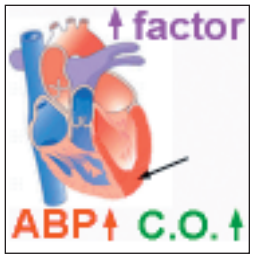
Cardiac Rhythm Override



Value: Sinus **(Default)**
Sinus Tachycardia
Sinus Tachycardia (120)
Sinus Bradycardia
Sinus Bradycardia (40)
Sinus with PACs
Atrial Fibrillation
Atrial Fibrillation (80)
Atrial Fibrillation (120)
Atrial Flutter
Atrial Flutter (150)
Sinus with 10% PVCs
Sinus with 25% PVCs
Ventricular Tachycardia
Ventricular Tachycardia (151)
Pulseless Ventricular Tachycardia
Pulseless Ventricular Tachycardia (151)
Coarse Ventricular Fibrillation
Fine Ventricular Fibrillation
PEA
Normal Junctional
Normal Junctional (50)
Paroxysmal Junctional Tachycardia
Paroxysmal Junctional Tachycardia (130)
Left Bundle Branch Block
Left Bundle Branch Block with PVCs
Right Bundle Branch Block
Third Degree AV Block
Mobitz Type I (Wenckebach)
Mobitz Type II
Myocardial Ischemia (mild)
Myocardial Ischemia (moderate)
Myocardial Ischemia (severe)
Myocardial Ischemia (moderate) PVCs
Asystole

Cardiac Rhythm Override is used to change the patient's underlying cardiac rhythm. To change the cardiac rhythm, select the desired rhythm and click Select. If a number appears following the cardiac rhythm, this also overrides the heart rate to the rate indicated. Cardiac rhythms without a number indicate that the heart rate can be independently controlled by using the **Heart Rate Factor** parameter.

Contractility Factor: Left Ventricle

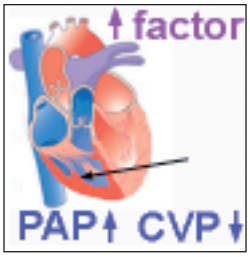


Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The baseline (before baroreceptor and drug influences are taken into account) left and right ventricular contractility are adjusted with these parameters. A value of 2 doubles the baseline contractility. A value of 0.5 decreases it by 50%. These parameters are typically used to configure a patient with decreased (or increased) myocardial contractility. Alternatively, they can be used in a subsequent scenario state to create acute myocardial depression.

Contractility Factor: Right Ventricle



Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The baseline (before baroreceptor and drug influences are taken into account) left and right ventricular contractility are adjusted with these parameters. A value of 2 doubles the baseline contractility. A value of 0.5 decreases it by 50%. These parameters are typically used to configure a patient with decreased (or increased) myocardial contractility. Alternatively, they can be used in a subsequent scenario state to create acute myocardial depression.

Fixed Heart Rate

Value: -1, 31 to 275 bpm **Default -1 bpm (model driven)**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

Typically, the heart rate is determined automatically by the physiologic models, which account for pharmacologic interventions and changes in patient physiology. The **Fixed Heart Rate** parameter is used to set the heart rate to a given number of beats-per-minute. Once set, administered drugs have no effect on the resulting heart rate, but continue to influence other components of the physiologic models. For example, administering epinephrine after setting the Fixed heart rate to 70 bpm results in an increased blood pressure (due to increased SVR) while holding the heart rate at 70 bpm.

Fixed heart rate can be set between 31 and 275 bpm, with a setting of –1 returning control of the underlying heart rate to the physiologic models.

NOTE: Settings between –1 and 31 cause an indeterminate result and are not recommended.

Heart Rate Factor

Value: 0.3 to 3 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

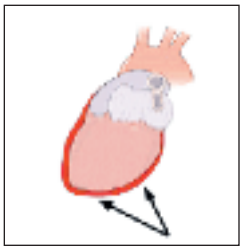
Typically the heart rate is determined automatically by the physiologic models, which account for pharmacologic interventions and changes in patient physiology. The **Heart Rate Factor** parameter is used to change the heart rate (HR) before baroreceptor, other physiological controls, and drug influences are taken into account. A value of 2 doubles the baseline HR. A value of 0.5 decreases the baseline HR by 50%. Note that the baroreceptor and other physiologic controls heavily influence the resulting HR. Thus, the observed HR may differ significantly from the set baseline HR. The **Heart Rate Factor** parameter can be used to configure a patient with an altered baseline HR. It is also used to create acute changes in HR during a scenario.

Heart Sounds

Value: Normal **(Default)**
S_3
S_4
S_3 and S_4
Early Systolic Murmur
Mid Systolic Murmur
Late Systolic Murmur
Holosystolic Murmur
Late Diastolic Murmur

Normal and abnormal heart sounds are selected using this parameter. Sounds are synchronized with the cardiac cycle. The volume control slider is used to increase or decrease the heart sound volume.

Pericardial Fluid (Acute)

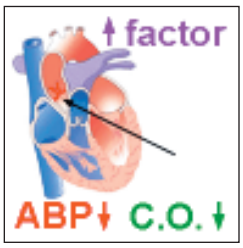


Value: 0 to 20 ml **Default 0 ml**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

Pericardial Fluid (Acute) is used to simulate the amount of fluid within the pericardial sac. This parameter may be used to simulate the infant with a cardiac tamponade.

Resistance Factor: Aortic Valve

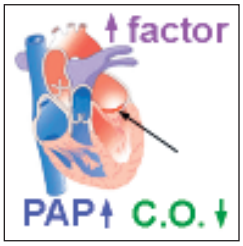


Value: 1 to 1000 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the resistance to blood flow across the aortic valve. The default value of 1 corresponds to the baseline aortic valve resistance of the selected patient; a value of 2 doubles the resistance. This parameter is used to create the hemodynamic effects of a reduced aortic valve area, as in the case of aortic stenosis.

Resistance Factor: Mitral Valve



Value: 1 to 1000 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the resistance to blood flow across the mitral valve. The default value of 1 corresponds to the baseline mitral valve resistance of the selected patient; a value of 2 doubles the resistance. This parameter is used to create the hemodynamic effects of a reduced mitral valve area, as in the case of mitral stenosis.

Resistance Factor: Pulmonic Valve

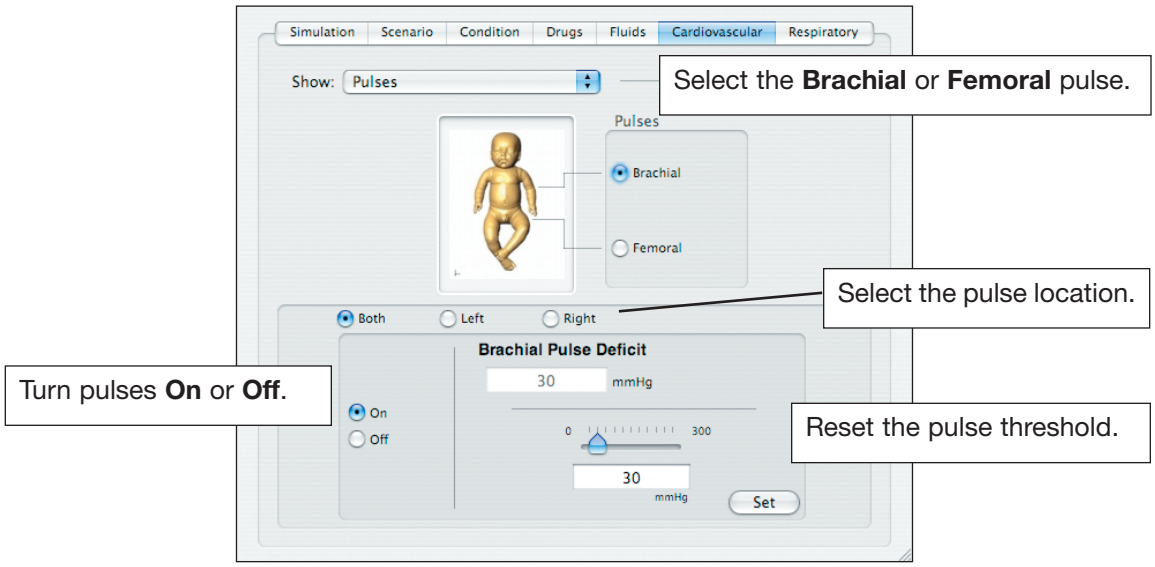
Value: 1 to 1000 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the resistance to blood flow across the pulmonic valve. The pulmonic valve parameter is used to create the hemodynamic effects of a reduced pulmonic valve area, as in the case of pulmonic stenosis. Setting this parameter to a high value creates the hemodynamic effects of a large gas embolus causing an air-lock in the right ventricular outflow track.

Pulses

Choosing **Pulses** in the **Show** menu displays the options for the **Brachial** and **Femoral** pulses, the two pulses palpable on the BabySIM mannequin.



Pulses

Pulses that are **On** are palpable at their respective locations when the systolic blood pressure is above the pulse deficit threshold. Selecting **Off** disables the pulse.

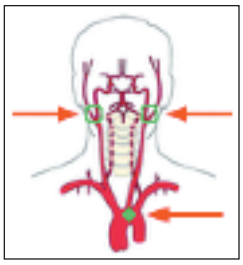
Since the default deficit is 30 mmHg the **Brachial** or **Femoral** pulse is palpable if the systolic blood pressure is above 30 mmHg and the **On** option has been selected. If the systolic blood pressure falls below 30 mmHg, the pulse “drops out” and is no longer palpable.

Palpable Pulse Thresholds	
Location	**Systolic Pressure Threshold**
Brachial	**30 mmHg**
Femoral	**30 mmHg**

Systemic

Choosing **Systemic** in the **Show** menu displays those parameters used to affect the patient's systemic vascular system. Systemic parameter values are controlled using numerical settings.

Baroceptor Gain (Overall) Factor

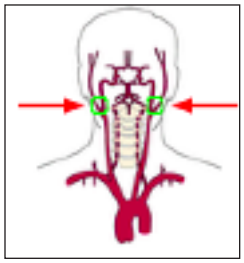


Value: 0 to 100 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The baroreceptor control section of the physiological models automatically and dynamically controls the simulated patient's heart rate, contractility, systemic vascular resistance, and venous capacity. The baroreceptor gain factor is a feedback multiplier that determines how vigorously the patient responds to changes in mean arterial pressure (MAP). A value of less than 1.0 corresponds to baroreceptor depression (i.e. less heart rate response to changes in MAP). A value greater than 1.0 leads to a stronger response to MAP changes.

Baroceptor Gain (Peripheral) Factor



Value: 0 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter selectively adjusts the influence of mean arterial pressure (MAP) on the peripheral effectors (systemic vascular resistance and venous capacity). A factor of less than 1 corresponds to baroreflex depression (e.g. less systemic vascular resistance response to MAP changes). A value greater than 1 leads to a stronger response to MAP changes. The effect of this factor and the **Baroreceptor Gain (Overall) Factor** is multiplicative.

Baroceptor Maximum Pressure

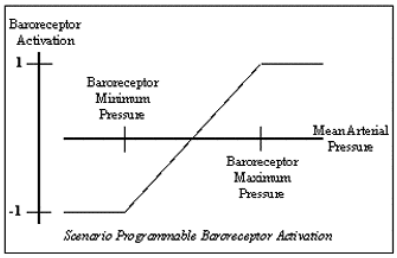
Value: 60 to 220 mmHg **Default 120 mmHg**

Onset: 0 to 60 seconds

0 to 60 minutes **Default 0 minutes**

The baroreceptor control mechanism attempts to maintain the mean arterial pressure (MAP) at a value halfway between the baroreceptor minimum pressure and baroreceptor maximum pressure. It does so primarily by influencing the heart rate, but also by influencing the myocardial contractility and arterial and venous vascular tone. The two parameters (minimum and maximum) must be adjusted together in order for the baroreceptor reset to be recognized by the software. Setting only the minimum or maximum pressure will not reset the baroreceptor response.

Baroreceptor maximum pressure defines the MAP at which the baroreceptor inhibitory activity on heart rate is maximal. Further increases in MAP above this value do not result in further increases in baroreceptor activity. Decreases in MAP below the baroreceptor maximum pressure cause proportional decreases in baroreceptor inhibitory activity on heart rate.



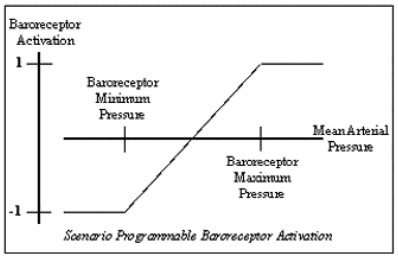
Baroceptor Minimum Pressure

Value: 40 to 160 mmHg **Default 80 mmHg**

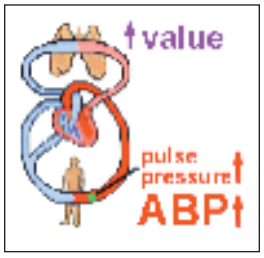
Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The baroreceptor control mechanism attempts to maintain the mean arterial pressure (MAP) at a value halfway between the baroreceptor minimum pressure and baroreceptor maximum pressure. It does so primarily by influencing the heart rate, but also by influencing the myocardial contractility and arterial and venous vascular tone. The two parameters (minimum and maximum) must be adjusted together in order for the baroreceptor reset to be recognized by the software. Setting only the minimum or maximum pressure will not reset the baroreceptor.

Baroreceptor minimum pressure defines the MAP at which the baroreceptor inhibitory activity on heart rate is minimal. Further decreases in MAP below this value do not result in further decreases in baroreceptor activity. Increases in MAP above the baroreceptor minimum pressure cause proportional increases in baroreceptor inhibitory activity on heart rate.



Elastance: Extrathoracic Arteries



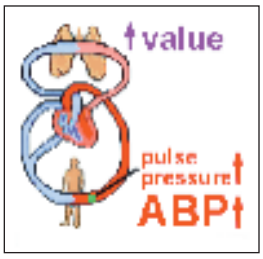
Value: 0.1 to 10 (mmHg/ml) **Default 3.02**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the elastance of the extrathoracic arteries. By altering the arterial elastance one can vary the systemic pulse pressure. Increasing the elastance value results in a wider pulse pressure. The systemic systolic and diastolic pressures should both increase and the pulse pressure will be greater.

This parameter should be altered in conjunction with the **Elastance: Intrathoracic Arteries.** Generally, both parameters should be altered in the same direction, i.e. both parameters should either be increased or decreased.

Elastance: Intrathoracic Arteries



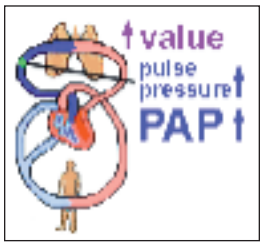
Value: 0.1 to 10 (mmHg/ml) **Default 7.76**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the elastance of the intrathoracic arteries. By altering the arterial elastance one can vary the systemic pulse pressure. Increasing the elastance value results in a wider pulse pressure. The systemic systolic and diastolic pressures should both increase and the pulse pressure will be greater.

This parameter should be altered in conjunction with the **Elastance: Extrathoracic Arteries.** Generally, both parameters should be altered in the same direction, i.e. both parameters should either be increased or decreased.

Elastance: Pulmonary Arteries



Value: 0.1 to 5 (mmHg/ml) **Default 1.27**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the elastance of the pulmonary arteries. By altering the arterial elastance one can vary the pulmonary pulse pressure. Increasing the elastance value results in a wider pulse pressure. The pulmonary systolic and diastolic pressures should both increase and the pulse pressure will be greater.

Resistance Factor: Pulmonary Vasculature

Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the baseline (before baroreceptor and drug influences are taken into account) pulmonary vascular resistance (PVR). A value of 2 doubles the baseline PVR. A value of 0.5 decreases PVR by 50%. This parameter can be used to configure a patient with an altered baseline PVR or to create acute changes in PVR during a scenario.

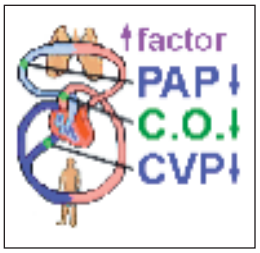
Resistance Factor: Systemic Vasculature

Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the baseline (before baroreceptor and drug influences are taken into account) systemic vascular resistance (SVR). A value of 2 doubles the baseline SVR. A value of 0.5 decreases SVR by 50%. This parameter can be used to configure a patient with altered baseline SVR such as the infant with hypertension or in septic shock. The parameter can also be used to create acute changes in SVR during a scenario.

Resistance Factor: Venous Return

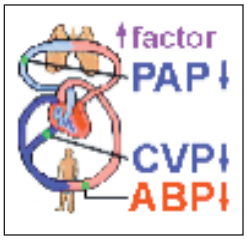


Value: 0.1 to 100 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the resistance between the extrathoracic and intrathoracic venous compartments. The default value of 1 corresponds to the baseline venous return resistance of the selected patient. A value of 2 doubles the resistance; a value of 0.5 reduces the resistance by 50%. This parameter is used to cause impeded venous return to the right heart. Clinical examples include increased intra-abdominal pressure, venous gas embolism, and valsalva maneuver.

Venous Capacity Factor



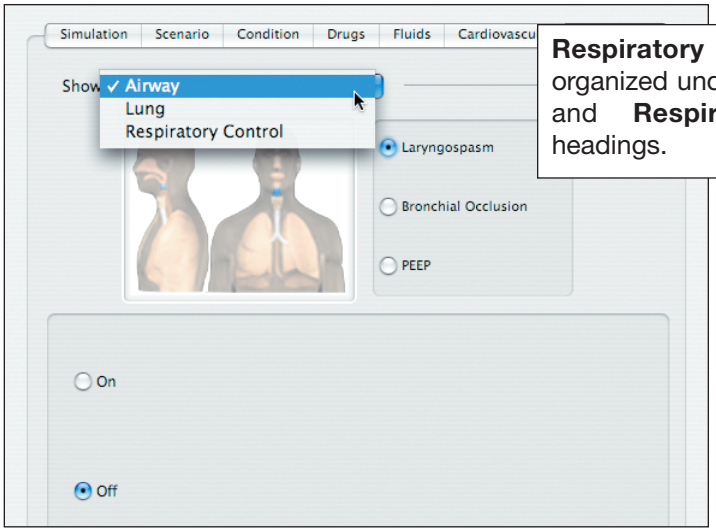
Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter adjusts the volume of blood that can be contained in the unstretched venous system without an increase in venous pressure. Additional volume greater than the set venous capacity causes distension of, and therefore, increased pressure within the venous system. A value of 2 doubles the capacity of the venous system (i.e. causing venous “pooling”); a value of 0.5 reduces the capacity of the venous system by 50% (e.g. following administration of a venoconstrictor).

The Respiratory Tab

Selecting the **Respiratory** tab opens a window providing a means of changing parameter settings that control patient conditions related to the respiratory system. **Airway** is selected by default in the **Show** menu, which also contains options for **Lung** and **Respiratory Control**. These two options also display a **Parameters** panel and a panel with the settings for those parameters. At the bottom of the **Lung** and **Respiratory Control** windows is a **Description** of the selected parameter.



The Respiratory Tab

The **Show** menu contains three sub-sections, each with its own set of parameters.

Respiratory Parameters		
Airway	**Lung**	**Respiratory Control**
Laryngospasm	Breath Sounds	CO_2 Production Factor
Bronchial Occlusion	Chest Wall Compliance Factor	CO_2 Setpoint
PEEP	Fraction of Inspired O_2 Override	Fixed Neuromuscular Blockade
	Functional Residual Capacity	I to E Ratio (1 : X)
	Intrapleural Volume	O_2 Consumption
	Lung Compliance Factor	Respiratory Gain Factor
	pH Shift	Respiratory Quotient
	Seesaw Breathing	Respiratory Rate Factor
	Venous CO_2 Shift	Respiratory Rate Override
		Shunt Fraction
		Tidal Volume Factor
		Tidal Volume Override
		Volume/Rate Control Factor

Airway

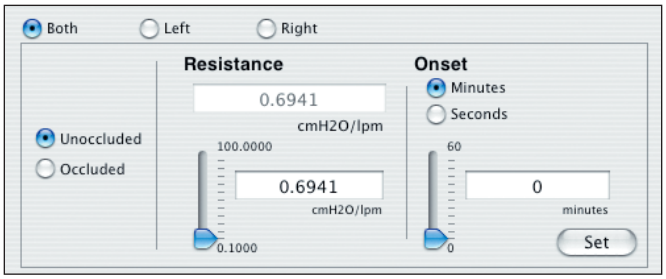
The **Airway** parameters are selected by clicking the corresponding radio button.

Laryngospasm

The **Laryngospasm** parameter can be turned **On** or **Off** using the radio buttons in the bottom panel. The default setting is **Off.**

Bronchial Occlusion

Selecting **Bronchial Occlusion** displays radio buttons for **Occluded** or **Unoccluded**.

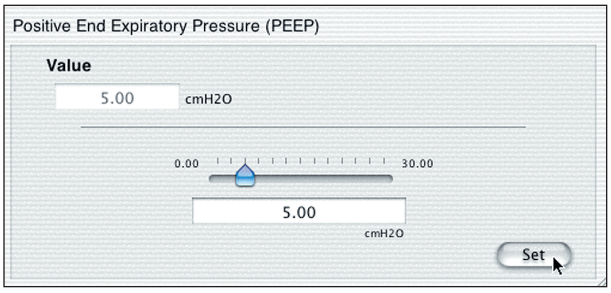


Bronchial Occlusion Settings

Selecting **Occluded** creates a 100% obstruction of the left and/or right mainstem bronchi and makes ventilation through the obstruction impossible. Setting the parameter to **Unoccluded** restores the mainstem bronchi to the flow resistance prior to occlusion. The rate of this resistance can be controlled using the **Resistance** and **Onset** settings. The default setting is **Unoccluded** in **Both** lungs at a rate of 0.6941 cmH_20/lpm.

PEEP

The **PEEP** parameter specifies the amount of positive end expiratory pressure applied during mechanical ventilation. Setting this parameter results in clinically appropriate intrathoracic pressures and hemodynamic responses.



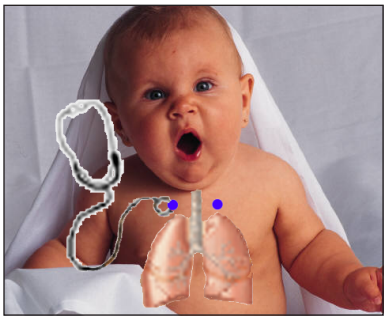
PEEP Settings

When applying a PEEP valve to a patient circuit (i.e. a ventilator), set the PEEP value within the software to get a true clinical response. The default setting is 0 cm H_2O.

Lung

Adjusting the **Lung** parameters affects the manner in which the patient's lungs function. Lung parameter values are controlled using either numerical or discrete settings, depending on the parameter.

Breath Sounds



Value: Normal **(Default)**
Biphasic Wheeze
Bronchovesicular
Crackles
Prolongation
Rhonchi
Stridor
Wheeze

Normal and abnormal breath sounds are selected using this parameter. Breath sounds are independently synchronized with ventilation of the left and right lungs. The volume control slider is used to increase or decrease the breath sound volume.

Chest Wall Compliance Factor

Value: 0.15 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter describes the interaction of the chest wall with the lungs. The chest wall compliance parameter defines the volume-pressure relationship in the normal operating lung volumes. Once distended, however, the chest wall rapidly becomes much less compliant (i.e. much "stiffer") and resistant to further inflation.

Fraction of Inspired Oxygen Override

Value: -1 to 100% **Default -1**

This parameter is used to simulate changes in the Fraction of Inspired Oxygen (FiO_2), such as would occur with the administration of supplemental oxygen.

Fraction of Inspired O_2 Override can be used in the following contexts:

Settings greater than 21% simulate the administration of supplemental oxygen.

Settings less than 21% simulate hypoxic conditions.

When set to -1, the FiO_2 defaults to the ambient concentration of oxygen in room air, about 21%.

Functional Residual Capacity

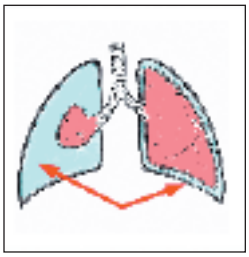
Value: 50 to 300 ml **Default 200 ml**

Onset: 0 to 60 seconds

0 to 60 minutes **Default 0 minutes**

Sets the total (combined left and right) lung volume remaining at the end of a normal, spontaneous, tidal volume. The minimum FRC with the baby mannequin is 50 ml.

Intrapleural Volume (Left)
Intrapleural Volume (Right)



Value:	0 to 100 ml	**Default 0 ml**
Onset:	0 to 60 seconds	
	0 to 60 minutes	**Default 0 minutes**

Normally, the visceral and parietal pleural surfaces are closely approximated with virtually no volume in between. The intrapleural volume parameters allow intrapleural volume to accumulate, for example, as happens during pneumothorax, hydrothorax, or hemothorax. Accumulation of a "displacing" volume in the intrapleural space causes compression of the lung tissue because both lung tissue and intrapleural volume are contained within the chest wall. Thus, attempts to inflate the compressed lung are prevented by the relative indistensibility of the chest wall at higher lung volumes.

Lung Compliance Factor (Left)
Lung Compliance Factor (Right)

Value:	0.15 to 10 (no units)	**Default 1**
Onset:	0 to 60 seconds	
	0 to 60 minutes	**Default 0 minutes**

These two parameters independently set the left and right lung compliance, respectively. With the **Lung Compliance Factor** set at 1, the resulting baseline compliance (combined lung and chest wall) is approximately 8 ml/cmH_2O. The lung compliance factors can be used to configure a patient with altered baseline lung compliance or to create acute changes during a scenario. For example, a patient who develops a "rigid chest" following administration of fentanyl. Low compliance factors (less than 1) create "stiff" lungs. High compliance factors (greater than 1) create "loose" lungs that easily inflate.

pH Shift

Value: -0.5 to 0.5 (no units) **Default 0**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter is used to create a metabolic acidosis or metabolic alkalosis under script control. Respiratory acidosis and respiratory alkalosis are simulated in real-time depending on the alveolar concentration of CO_2.

Please note that changes in pH may alter the shape of the standard oxyhemoglobin dissociation curve as described below:

As acidity increases (pH decreases), the affinity of hemoglobin for oxygen decreases, and oxygen dissociates more readily from hemoglobin. In other words, increasing acidity enhances the unloading of oxygen from hemoglobin.

When pH decreases, the entire oxyhemoglobin dissociation curve shifts to the right, a change termed the Bohr effect. By contrast, elevated pH increases the affinity of hemoglobin for oxygen and shifts the dissociation curve to the left.

Seesaw Breathing

Value: On
Off **(Default)**

During normal spontaneous infant breathing, the chest rises and the abdomen follows with only a brief lag. In seesaw or “paradoxical respiration,” the abdominal wall moves inward during inspiration and rises during expiration. It is observed as a sign of upper airway obstruction or less frequently can be a sign of decreased compliance (pneumonia, pulmonary) or elevated resistance (asthma). When On is selected the mannequin will exhibit a seesaw pattern of respiration (chest retraction with abdominal distension) such as seen with respiratory distress and impending respiratory failure in the infant.

Venous Carbon Dioxide Shift

Value:	0 to 60 mmHg	**Default 0 mmHg**
Onset:	0 to 60 seconds	
	0 to 60 minutes	**Default 0 minutes**

The partial pressure of CO_2 in the venous blood is affected with this parameter. Changing this parameter allows large and rapid shifts in total body CO_2 concentration. Increases in alveolar and arterial CO_2 follow rapidly in a physiologically correct magnitude and time course.

Respiratory Control

Respiratory Control parameters affect the patient's respiratory drive. Respiratory Control parameter values are controlled using numerical or discrete settings.

Carbon Dioxide Production Factor

Value: 0.5 to 5.0 (no units) **Default 1.0**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter allows for the manipulation of metabolic CO_2 production to simulate a variety of (patho)physiological conditions. When set to the default value of 1, CO_2 production is determined by the **O_2 Consumption** and **Respiratory Quotient** settings. A value of 2 doubles the CO_2 production. A value of 0.5 decreases the CO_2 production by 50%. Note that the control of breathing to maintain arterial carbon dioxide tension and prevent hypoxemia along with other physiologic controls heavily influence the resulting $PaCO_2$.

When set from 2 to 3, this parameter can be used to simulate the rate of rise of $PaCO_2$ for an apneic anesthetized patient.

Carbon Dioxide Setpoint

Value: 20 to 70 mmHg **Default 40 mmHg**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter is a setpoint for $PaCO_2$. The control-of-breathing model adjusts tidal volume and respiratory rate in order to bring the $PaCO_2$ towards this setpoint. Factors that influence the "success" of this control effort include baseline tidal volume, baseline respiratory rate, respiratory gain, O_2 consumption, respiratory quotient, lung compliances, chest wall compliance, bronchial resistances, the presence of artificial airways in the mannequin, and the inspired gas mixture. Many of these factors can be adjusted by selecting the specific parameter under the **Lung** or **Respiratory Control** section of the **Respiratory** tab.

Fixed Neuromuscular Blockade

Value: -1, 0 to 100% **Default -1 (model driven)**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The degree of neuromuscular blockade is determined automatically by the pharmacokinetic and pharmacodynamic models based on the neuromuscular blocking agents administered and the time course of their injection. For some educational applications, however, the instructor may wish to set a fixed degree of neuromuscular blockade that remains stable for an indefinite period of time. This can be accomplished using the **Fixed Neuromuscular Blockade** parameter. The default value of –1 instructs the pharmacologic models to determine the degree of neuromuscular blockade based upon the drugs injected and their pharmacologic properties.

When any other positive value is assigned to this parameter, the degree of neuromuscular blockade is set to that level. For example, **Fixed Neuromuscular Blockade 80** causes the simulator to set the degree of neuromuscular blockade to 80%, regardless of the presence (or absence) of neuromuscular blocking drugs. Clinically, the spontaneous tidal volume is markedly reduced.

I to E Ratio (1:x)

Value: 0.5 to 7 (no units) **Default 2**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter sets the inspiratory-expiratory (I:E) ratio for spontaneous ventilation.

Oxygen Consumption

Value: 0 to 300 ml/min **Default 80 ml/min**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter is used to change the rate of consumption of oxygen and production of carbon dioxide. Also see **Respiratory Quotient.**

Respiratory Gain Factor

Value: 0 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The respiratory control section of the physiological model automatically and dynamically controls the simulated patient's tidal volume and respiratory rate to maintain a normal arterial carbon dioxide tension and to prevent arterial hypoxemia.

Respiratory Quotient

Value: 0.7 to 1.2 (no units) **Default 0.95**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

Respiratory quotient is the rate of carbon dioxide production divided by the rate of oxygen consumption. Changes to the **Respiratory Quotient** parameter alter the rate of carbon dioxide production relative to the rate of oxygen consumption. Also see **Oxygen Consumption.**

Respiratory Rate Factor

Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The underlying tidal volume (TV) and respiratory rate (RR) for the respiratory section of the physiological model are 80 ml and 40 breaths/minute, respectively. The **Tidal Volume Factor** and **Respiratory Rate Factor** parameters are used to change these baselines before the control of breathing and drug influences are taken into account. A value of 2 doubles the baseline TV or RR. A value of 0.5 decreases the baseline TV or RR by 50%. Note that the control of breathing to maintain arterial carbon dioxide tension and prevent hypoxemia and other physiologic controls heavily influence the resulting TV and RR. Thus, the observed TV and RR may differ significantly from the baseline TV and RR. The **Tidal Volume Factor and Respiratory Rate Factor** parameters can be used to configure a patient with altered breathing pattern such as the tachypneic patient in heart failure. These are also used to create acute changes in TV and RR during a scenario.

Note that unless the **Respiratory Gain Factor** is decreased, changes in **Tidal Volume Factor** and **Respiratory Rate Factor** will be somewhat offset or minimized by the respiratory control mechanism as they attempt to maintain a normal $PaCO_2$.

Respiratory Rate Override

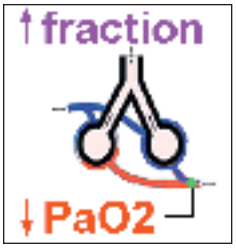
Value: -1.0 to 80 (breaths/min) **Default -1 (model driven)**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The underlying tidal volume (TV) and respiratory rate (RR) for the respiratory section of the physiological model are 80 ml and 40 breaths/minute, respectively. The **Respiratory Rate Override** parameter is used to set the respiratory rate to a given number of breaths-per-minute. Once set, arterial oxygen and carbon dioxide values have no effect on the resulting respiratory rate, but continue to influence other components of the physiological models. For example, with the respiratory rate override set to 60 breaths/minute this will result in a fixed respiratory rate, regardless of arterial oxygen or carbon dioxide levels. However, the respiratory control mechanism will adjust the tidal volume in an attempt to maintain normal $PaCO_2$ levels.

Respiratory rate override can be set between 1 and 80 breaths/min, with a setting of -1 returning control of the underlying respiratory rate to the physiological models.

Shunt Fraction



Value: 0 to 0.5 (no units) **Default 0.01**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

This parameter is used to create oxyhemoglobin desaturation in a variety of clinical contexts. The physiologic model uses the **Shunt Fraction** parameter to determine what portion of blood passes through the pulmonary shunt circulation (i.e. does not exchange oxygen, carbon dioxide, and anesthetic gases with the alveolar gas). Typically, values of 0.10 to 0.40 are needed to create large alveolar-arterial oxygen gradients sufficient to cause arterial hypoxemia.

Tidal Volume Factor

Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The underlying tidal volume (TV) and respiratory rate (RR) for the respiratory section of the physiological model are 80 ml and 40 breaths/minute, respectively. The **Tidal Volume Factor** and **Respiratory Rate Factor** parameters are used to change these baselines before the control of breathing and drug influences are taken into account. A value of 2 doubles the baseline TV or RR. A value of 0.5 decreases the baseline TV or RR by 50%. Note that the control of breathing to maintain arterial carbon dioxide tension and prevent hypoxemia and other physiologic controls heavily influence the resulting TV and RR. Thus, the observed TV and RR may differ significantly from the baseline TV and RR. The **Tidal Volume Factor and Respiratory Rate Factor** parameters can be used to configure a patient with altered breathing pattern such as the tachypneic patient in heart failure. These are also used to create acute changes in TV and RR during a scenario.

Note that unless the **Respiratory Gain Factor** is decreased, changes in **Tidal Volume Factor** and **Respiratory Rate Factor** will be somewhat offset or minimized by the respiratory control mechanism as they attempt to maintain a normal $PaCO_2$.

Tidal Volume Override

Value: -1 to 400 ml **Default -1 (model driven)**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

The underlying tidal volume (TV) and respiratory rate (RR) for the respiratory section of the physiological model are 80 ml and 40 breaths/minute, respectively. The **Tidal Volume Override** parameter is used to set the tidal volume to a given volume per breath. Once set, arterial oxygen and carbon dioxide values have no effect on the resulting tidal volume, but continue to influence other components of the physiological models. For example, with the tidal volume override set to 100 ml this will result in a fixed tidal volume, regardless of arterial oxygen or carbon dioxide levels. However, the respiratory control mechanism will adjust the respiratory rate in an attempt to maintain normal $PaCO_2$ levels.

Tidal volume override can be set to a maximum of 400 ml, with a setting of -1 returning control of the underlying respiratory rate to the physiological models.

Volume/Rate Control Factor

Value: 0.1 to 10 (no units) **Default 1**

Onset: 0 to 60 seconds
0 to 60 minutes **Default 0 minutes**

Ventilatory responses to increased arterial carbon dioxide or decreased arterial oxygen may take the form of increased tidal volume, increased respiratory rate, or both. The **Volume/Rate Control Factor** determines these relative changes. At a value of 1, increased and decreased ventilatory drive affect tidal volume and respiratory rate equally. When **Volume/Rate Control Factor** is greater than 1, increased or decreased minute ventilation is predominantly achieved by changes in tidal volume. When the **Volume/Rate Control Factor** is less than 1, ventilation changes are affected primarily by changes in respiratory rate.

Using the System

Once the BabySIM system is operational and the software has loaded, changes to the patient's physiology manifested in the mannequin and on the waveform display are controlled using the software accessed on the Patient window.

Defining Patient Profiles

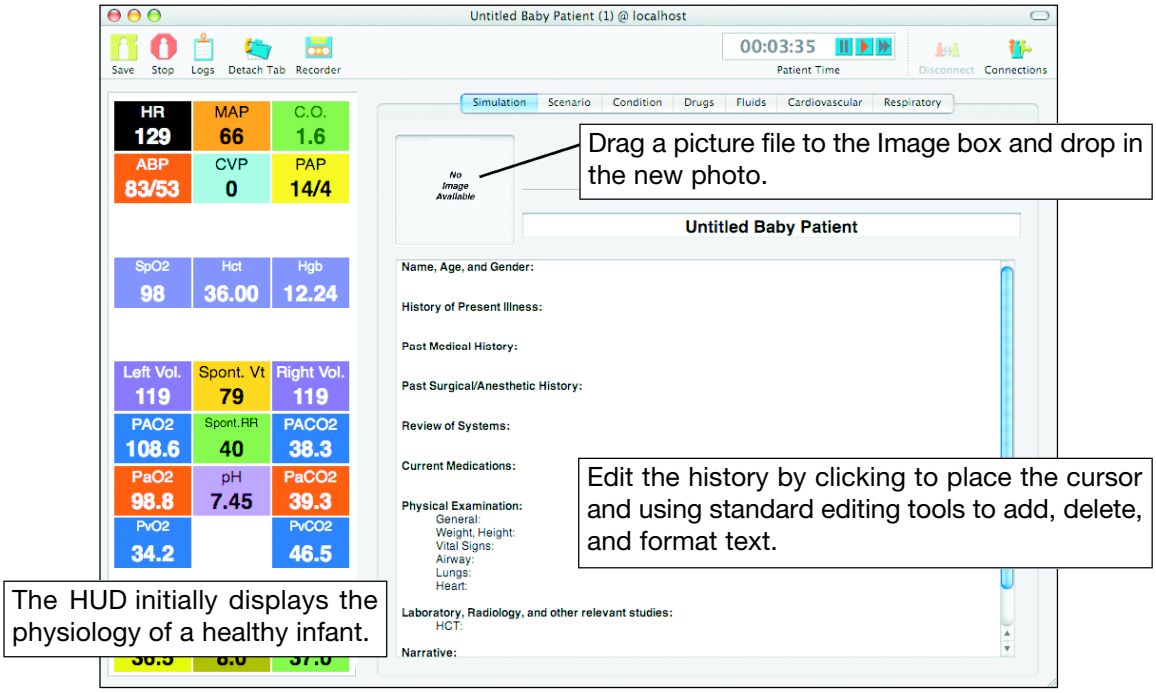
An unlimited number of unique patient profiles are possible for the BabySIM. Baby Ryan, the preconfigured patient, represents a healthy male infant and provides a baseline for modified or customized patients.

Baby Ryan™	
Name, Age, and Gender	Ryan, 6-month-old male
History of Present Illness	Healthy infant
Past Medical History	None 39-week gestation, uncomplicated vaginal delivery; APGAR 9/9 No perinatal complications. Infant went home on day of life 1. No known drug allergies.
Past Surgical/Anesthetic History	None
Current Medications	Vitamins with iron
Family History	Not contributory
Social History	**Immunizations:** Hep B, DTaP, IPV, HIB, pneumococcal up-to-date **Diet:** Maternal breast milk, rice cereal **Other:** Lives with parents, Stan D. and Stannette Ardman and a 6-year-old sibling
Review of Symptoms	Eating well, no fevers Negative for seizure No history of heart murmur, no diaphoresis with meals No cough, wheeze, or noisy breathing No vomiting, constipation, diarrhea, or jaundice No rash
Physical Examination	**General:** Healthy appearing, well nourished, alert, and active infant, nondistressed **Weight, Height:** 8 kg (50%ile), length 66 cm (30%ile), head circumference 38 cm (50%ile) **Vital Signs:** Heart Rate 129 beats per minute, Blood Pressure 86/45 mmHg, Respiratory Rate 40 breaths per minute, SpO_2 98% **HEENT:** Anterior fontanel soft and flat, anicteric sclera, normal red reflex, no strabismus, tympanic membranes normal, palate intact **Airway:** Normal infant, mandible normal **Lungs:** Comfortable breathing, clear bilaterally to auscultation, and percussion **CV:** S_1 normal, S_2 splits normally. No murmur or adventitious sounds. Pulses normal and equal in both upper and lower extremities **Abdomen:** Soft, nondistended, liver edge at right costal margin, spleen nonpalpable, bowel sounds normoactive **GU:** Testes bilaterally descended **Neuro:** PERRL, normal deep tendon reflexes, strength, and tone **Developmental:** Rolls over, sits up alone, reaches for objects, recognizes strangers
Laboratory, Radiology, and Other Relevant Studies	**Hemoglobin:** 12.24g/dL **Hematocrit:** 36%

Developing a New Patient

Patients are created either by modifying an existing patient or by clicking the **New** icon on the Patient Palette and selecting the **Untitled Baby Patient** option (see **Creating a New Patient** in the **Software Basics** section of this User Guide).

When a new patient is created, the Patient window appears without information regarding the new baby patient's name, history or photograph. However, the initial underlying physiology of the new baby patient is that of Baby Ryan, the healthy, preconfigured patient.



The Untitled Baby Patient Window

To complete the patient, new information needs to be added and the physiology changed.

Adding a Photograph

If desired, load a picture file (e.g. TIFF, JPEG, GIF) onto the laptop, select the file from the desktop, drag the file to the Image box to the left of the patient's name, and release the file. The new picture appears in the Image box, replacing the text, "No Image Available."

Completing the Patient History

To create the patient's history, click the mouse in the appropriate spot on the history field and enter the desired text. The standard **Cut**, **Copy**, **Paste** and **Clear** functions are available via the **Edit** menu when text is highlighted. Text formatting (i.e. **Bold**, **Underline**, **Italics**) is available via the **Format** menu.

To remove the entire history, click anywhere in the text and choose the **Select All** option from the **Edit** menu before pressing the **Delete** key. New text can be entered on the blank page.

Any changes to the history must be saved to have them for future reference.

Changing the Patient's Physiology

A patient's physiology is changed by adjusting the parameters available beneath the various tabs located on the Patient window.

To create a new physiology for the patient:

1. Select the appropriate tab (e.g. **Cardiovascular** tab, **Respiratory** tab).
2. Select, when available, the appropriate tab sub-category (from the **Show** pull-down menu).
3. Choose the desired parameter (e.g. **Heart Rate Factor**, **Breath Sounds**).
4. Change the values of the selected parameter.
5. Allow the patient's vital signs to stabilize. Cardiovascular changes usually equilibrate rapidly whereas respiratory changes may take several minutes to stabilize.
6. Save (when desired) the new patient.

New patients are saved using the **Save** icon on the Patient window or the **Save** option located on the **File** menu. For more information on saving patient files, see **Saving Patient Files** found in **Software Basics** section of this User Guide.

Details regarding the various parameters are located in the **Tabs** section of this User Guide.

Altering an Existing Patient

Any existing patient, either Baby Ryan or a previously saved user-defined patient, can be changed to display a different name, background or physiology.

The original file for Baby Ryan cannot be overwritten, so a new file name must be created for edited versions of this preconfigured patient. Unless permanently modifying a user-defined patient file, any changes to a user-defined patient should be saved using the **Save As** option under the **File** menu. All changes must be saved to preserve the patient file for future use.

Editing the Patient History

To edit the patient's history, highlight and type over the existing text. The standard **Cut**, **Copy**, **Paste** and **Clear** functions are available via the **Edit** menu when text is highlighted. Text formatting (i.e. **Bold**, **Underline**, **Italics**) is available via the **Format** menu. To remove the entire history, click anywhere in the text and choose the **Select All** option from the **Edit** menu before pressing the **Delete** key. New text can be entered on the blank page.

Any changes to the history must be saved to have them for future reference.

Changing the Patient's Physiology

A patient's physiology is changed by adjusting the parameters available beneath the various tabs located on the Patient window.

To edit an existing patient:

1. Select the appropriate tab (e.g. **Cardiovascular** tab, **Respiratory** tab).
2. Select, when available, the appropriate tab sub-category (from the **Show** pull-down menu).
3. Choose the desired parameter (e.g. **Heart Rate Factor**, **Breath Sounds**).
4. Change the values of the selected parameter.
5. Allow the patient's vital signs to stabilize. Cardiovascular changes usually equilibrate rapidly whereas respiratory changes may take several minutes to stabilize.
6. Save (when desired) the modified patient.

For more information on saving patient files, see **Saving Patient Files** found in **Software Basics** section of this User Guide. Details regarding the various parameters are located in the **Tabs** section of this User Guide.

Employing Clinical Features

The method of producing a specific clinical situation may involve the mannequin, the software, or both. Likewise, user interventions can take place with the mannequin, the software, or with a combination of the two. Below is a breakdown of the various clinical features and how they are utilized.

Airway Management

The mannequin's anatomically realistic upper airway provides for the opportunity to intubate the infant patient, while various clinical signs (i.e. breath sounds, chest excursion, airway patency) can be simulated using software commands.

Airway Management			
Anatomy, Physiology, and Clinical Signs	**Clinical Interventions, Patient Monitoring, and Scenarios**	**Software Control**	**Manual Control**
Realistic Upper Airway (Oropharynx, Nasopharynx,and Larynx)	**Direct laryngoscopy Oral and nasal intubation Specialty airway devices (e.g. endotracheal tubes, combitubes, and oropharyngeal airways)**	None required.	None required.
Esophagus, Lower Esophageal Sphincter, and Stomach	**Esophageal intubation results in gastric distention and the absence of breath sounds, chest excursion, and CO_2 output.**	None required.	None required.
Laryngospasm	**Closes vocal cords and prevents intubation and ventilation.**	TAB: **Respiratory** SHOW: **Airway** RADIO BUTTON: **Laryngospasm** See page 5.74	None required.
Bronchial Occlusion	**Completely obstructs the right and left mainstem bronchi, simulating a lower airway obstruction (e.g. mucus plug). This yields an inability to ventilate the lungs.**	TAB: **Respiratory** SHOW: **Airway** RADIO BUTTON: **Bronchial Occlusion** See page 5.74	None required.
Baby Sounds	**Sounds include Baby Talk, Cooing, Cough, Crying, Gooing, High Pitched Cry, Screaming and Sneezing.**	None required, but volume can be adjusted. TAB: **Condition** SHOW: **Assessment** PARAMETER: **Baby Sounds** See page 5.40	None required.
Phonation and Patient Voice	**Allows the mannequin to provide an audible response.**	None required, but volume can be adjusted. TAB: **Condition** SHOW: **Assessment** PARAMETER: **Microphone Volume** See page 5.45	Set channels and adjust the volume on the wireless microphone.

Most sounds (i.e. Breath Sounds and Baby Sounds) are controlled through the software, but a wireless microphone is available to provide additional phonation or a voice from the patient. To use the wireless microphone, attach the transmitter to a belt or pocket and snap the microphone to a lapel or shirt pocket.

Verify that the two antennas located behind the wireless receiver on the PCU are extended and that the transmitter has been set to the same channel as the receiver on the PCU.

Switch the receiver and the microphone to the ON position.

Pulmonary System

The mannequin's lungs produce carbon dioxide and react realistically to intubation as well as to pathophysiologic states. The patient's upper chest rises and falls synchronously with the inflationary state of the underlying lungs.

Pulmonary System			
Anatomy, Physiology, and Clinical Signs	**Clinical Interventions, Patient Monitoring, and Scenarios**	**Software Control**	**Manual Control**
Spontaneous, Self-Regulating Breathing	**Normal tidal breathing and pathophysiological conditions such as atelectasis, pneumothorax and asthma.**	None required, but adjustable. TAB: **Respiratory** SHOW: **Respiratory Control** PARAMETERS: **ALL** See pages 5.80 to 5.86	None required.
Exhaled CO_2	**Measure the presence or absence of exhaled CO_2.**	None required.	CO_2 source required.
Symmetric and Asymmetric Lung Ventilation	**Tracheal, pathophysiologic conditions such as pneumothorax.**	None required, but adjustable. TAB: **Respiratory** SHOW: **Lung** and/or **Airway** PARAMETERS: **ALL** See pages 5.74 to 5.79	None required.
Chest Excursion	**Synchronized with ventilation (spontaneous or mechanical). Excursion depth proportional to tidal volume.**	None required.	None required.
Breath Sounds	**Normal and abnormal breath sounds are independently synchronized with ventilation of the right and left lungs. Breath sounds can be auscultated over the apex of each lung.**	None required, but adjustable. TAB: **Respiratory** SHOW: **Lung** PARAMETER: **Breath Sounds** See pages 5.75 to 5.79	None required.
Pulse Oximetry	**Oxyhemoglobin saturation (SpO_2) automatically correlates with the oxygen concentration in the lungs and the intrapulmonary shunt fraction.**	None required, but adjustable. TAB: **Respiratory** SHOW: **Respiratory Control** PARAMETER: **Shunt Fraction** See page 5.84	None required.
Arterial Blood Gases	**PaO_2, $PaCO_2$, and pH are continuously calculated and displayed on the HUD.**	None required, but adjustable. TAB: **Respiratory** SHOW: **Lung** and/or **Respiratory Control** PARAMETERS: Multiple See pages 5.75 to 5.86	None required.
Venous Blood Gases	**PvO_2 and $PvCO_2$ are continuously calculated and displayed on the HUD.**	None required, but adjustable. TAB: **Respiratory** SHOW: **Lung** and/or **Respiratory Control** PARAMETERS: Multiple See pages 5.75 to 5.86	None required.

Cardiovascular System

The mannequin produces realistic heart sounds and a wide range of pathophysiologic conditions synchronized to the QRS complex of the ECG and audible to a standard stethoscope.

Cardiovascular System			
Anatomy, Physiology, and Clinical Signs	**Clinical Interventions, Patient Monitoring, and Scenarios**	**Software Control**	**Manual Control**
Heart Sounds	**Normal and abnormal heart sounds are synchronized with the QRS complex of the ECG. Heart sounds can be auscultated over the left and right upper sternal border, right lower sternal border and apex.**	None required, but specific sounds can be selected. TAB: **Cardiovascular** SHOW: **Heart** PARAMETER: **Heart Sounds** See page 5.64	None required.
3-Lead ECG	**ECG waveforms can be viewed on a standard monitor and/or on the Waveform Display Monitor. Normal and abnormal cardiac rhythms are linked to patient physiology (e.g. blood pressure, cardiac output).**	None required, but specific rhythms can be selected. TAB: **Cardiovascular** SHOW: **Heart** PARAMETER: **Cardiac Rhythm Override** See page 5.61	None required.
Palpable Pulses	**Brachial and femoral pulses can be palpated bilaterally and are synchronous with the cardiac cycle. A pulse deficit automatically occurs if the systolic arterial blood pressure falls below specified thresholds. See the Palpable Pulse Thresholds chart on page 5.8.**	None required, but adjustable. TAB: **Cardiovascular** SHOW: **Pulses** See page 5.66	None required.
Manual Blood Pressure	**Systemic blood pressure can be measured using the return-to-flow technique. Korotkoff sounds can also be auscultated.**	None required.	See **Manual Blood Pressure** for using the modified blood pressure cuff, page 6.9.
Invasive Hemodynamic Monitoring	**See the Invasive Hemodynamic Monitoring chart on page 5.8.**	None required, but adjustable. TAB: **Cardiovascular** SHOW: **Catheters** PARAMETERS: **ALL** See pages 5.56 to 5.57	None required.
Baroreceptor Reflex	**Cardiovascular system automatically compensates for changing hemodynamic conditions.**	None required, but adjustable. TAB: **Cardiovascular** SHOW: **Heart** PARAMETER: **Baroreceptor Gain (Cardiac) Factor** See page 5.60 SHOW: **Systemic** PARAMETER: **All Baroceptor Selections** See pages 5.67 to 5.69	None required.
Circulation	**Normal and abnormal circulation (e.g. hypovolemia, hypervolemia, and right/left heart failure).**	None required, but adjustable. TAB: **Fluids** PARAMETER: **Volume** See pages 5.51 to 5.54 TAB: **Cardiovascular** SHOW: **Heart** PARAMETER: **All Contractility Selections** See page 5.62	None required.

Palpable Pulse Thresholds

A pulse deficit automatically occurs when the systolic arterial blood pressure falls below the following thresholds:

Palpable Pulse Thresholds	
Location	**Systolic Pressure Threshold**
Brachial	30 mmHg
Femoral	30 mmHg

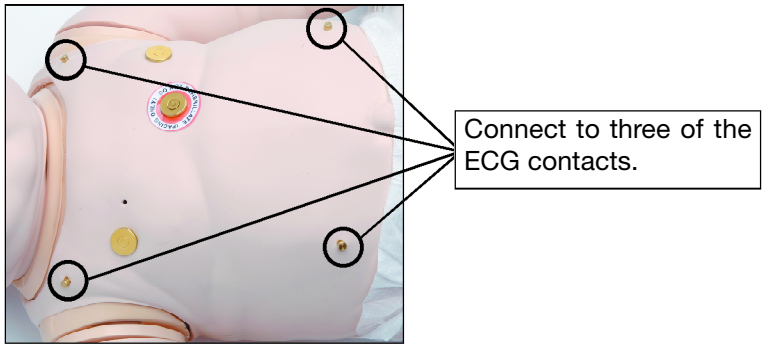
Invasive Hemodynamic Monitoring

The following parameters can be displayed on the Waveform Display Monitor:

Invasive Hemodynamic Monitoring
Arterial Blood Pressure
Central Venous Pressure
Right Atrial Pressure
Right Ventricular Pressure
Pulmonary Artery Pressure
Pulmonary Artery Occlusion (Wedge) Pressure

ECG Signals

To produce ECG signals on a monitor, connect a 3-lead unit to three of the four contacts (or snaps) located on the mannequin. The fourth contact may be used as a ground.



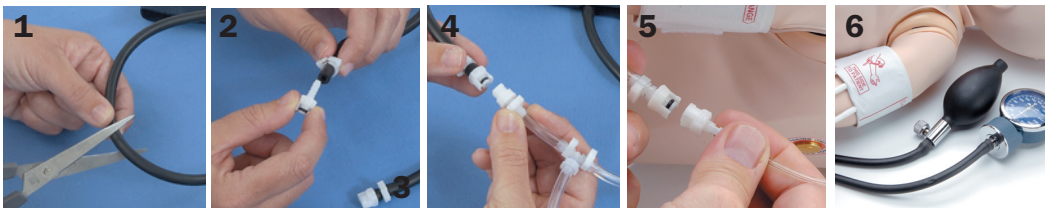
ECG Contacts

Manual Blood Pressure

To use noninvasive blood pressure monitoring techniques (i.e. a blood pressure cuff), configure a standard infant cuff with the supplied T-fitting and adapters:

Blood Pressure Cuff Splice Kit

1. Cut the hose that connects to the pressure gauge on the cuff.
2. Insert one of the supplied adapter fittings into each of the open ends of the tube, using a female fitting on one end and a male fitting on the remaining end.



3. Attach the adapter cuff around the tubing to hold the adapter fitting into place.
4. Insert the T-fitting into the hose adapters, noting the male and female connections.
5. Connect the remaining portion of the T-fitting to the hose located on the mannequin's shoulder just behind the left arm.
6. Attach the cuff to the upper left arm and take the noninvasive blood pressure reading using the return-to-flow technique.

Store the modified blood pressure cuff with the BabySIM system for future reuse.

Korotkoff Usage

To use this feature:

1. Have the learner palpate the left brachial pulse to identify its presence or absence.
2. As the learner places the stethoscope in his or her ears, disable the left brachial pulse by clicking the **Off** selection on the **Pulses** screen of the **Cardiovascular** tab (See page 6.66).
3. Allow the learner to auscultate the BP, hearing the beginning of sounds at the systolic pressure and the absence of sounds indicating the diastolic pressure.
4. Next, enable the left brachial pulse by clicking the **On** selection on the **Pulses** screen of the **Cardiovascular** tab (See page 5.66).

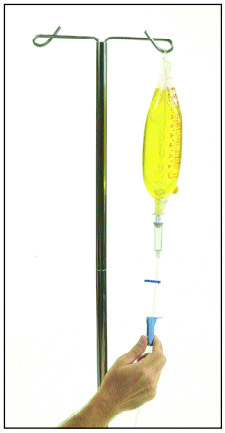
Metabolic System

The BabySIM patient mannequin delivers metabolic features that are physiologically modeled within the software so that the results are made available on the Instructor Workstation or the optional Remote Control. The ABG data displayed corresponds accurately and dynamically to the alveolar concentration of CO_2 and O_2. Metabolic acidosis and alkalosis are simulated with a few simple adjustments to the ABG pH level made by the instructor. For example, simple calibrations can accurately simulate a patient response to metabolic acidosis.

Genitourinary System

To use the Genitourinary features:

1. Insert the genitalia desired for the exercise.
2. Set the IV pole set up near the PCU.
3. Fill an IV bag and attach it to the supplied IV solution set to yield a clinically appropriate colored liquid (e.g. for simulated urine, add 1 to 2 cc of yellow food dye per liter of distilled water and mix to achieve the desired color). Be careful not to make the mixture too thick as this can clog the system.
4. Verify that the dark blue slide clamp and the light blue roller clamp are in the closed position to close off the flow before filling and hanging the bag.
5. Hang the bag on the IV pole.



GU Source Bag

6. Connect the mannequin by attaching the end of the IV solution set to the orange hose in the Umbilical Assembly.
7. Open the clamp and allow fluid to flow into the mannequin. There is a reservoir inside the mannequin that serves as a bladder and will fill up with the fluid.
8. When fluid begins to flow from the mannequin, adjust the clamp to control the flow.

Measurement of urinary output can be made by weighing the diaper.

NOTE: Clean up is very important when using simulated fluids. See page 7.6 of the **Care/Maintenance** section of this User Guide for proper clean up instructions.

Pediatric Advanced Life Support (PALS) System

The BabySIM system includes several realistic Pediatric Advanced Life Support (PALS) System modules offering advanced hands-on skills acquisition in airway management and ventilation, chest compression, as well as the use of defibrillators and transthoracic cardiac pacers.

Pediatric Advanced Life Support (PALS) System			
Anatomy, Physiology, and Clinical Signs	**Clinical Interventions, Patient Monitoring, and Scenarios**	**Software Control**	**Manual Control**
Airway Management and Ventilation	**Alveolar and arterial gas concentrations appropriately reflect the efficacy of ventilation and oxygen administration.**	Oxygen administration must be input by the instructor. TAB: **Respiratory** SHOW: **Lung** PARAMETER: **Fraction of Inspired O_2 Override** See page 5.76	None required.
Chest Compression	**Effective chest compression results in artificial circulation, cardiac output, central and peripheral blood pressures, palpable pulses, and CO_2 return.**	None required, but adjustable. TAB: **Condition** SHOW: **Trauma** PARAMETER: **Chest Compression Efficacy** See page 5.47	None required.
Cardiac Arrhythmias	**The desired arrhythmia can be selected.**	The response to clinical intervention must be controlled by the instructor. TAB: **Cardiovascular** SHOW: **Heart** PARAMETER: **Cardiac Rhythm Override** See page 5.61	None required.
Defibrillation	**The BabySIM supports operation with a variety of manual defibrillators.**	Defibrillation can be simulated by the instructor. TAB: **Cardiovascular** SHOW: **External Cardiac Simulation** PARAMETER: **Defibrillation** See page 5.58	See **Defibrillation** for defibrillation disk locations and instructions, pages 6.12 and 6.13.
Cardiac Pacing	**Transthoracic cardiac pacers can be used with the BabySIM. Pacing results in appropriate physiological changes in blood pressure and cardiac output.**	The instructor can set the level at which electrical capture and mechanical capture occur. TAB: **Cardiovascular** SHOW: **External Cardiac Simulation** PARAMETERS: **All Pacing Parameters** See pages 5.58 to 5.59	See **Pacing** for cardiac pacing disk locations and instructions, page 6.13.

Chest Compression

The patient mannequin supports normal finger placement and standard compression techniques. Set the mannequin on a safe and sturdy work surface when administering chest compressions.

Defibrillation

The BabySIM is designed to safely absorb the energy discharged from manual defibrillators. However, use of a defibrillator for training purposes represents an operational hazard equivalent to use of a defibrillator on a real patient. Consequently, all safety precautions for use of defibrillators must be followed as if the mannequin were a patient. Consult the defibrillator's User Manual for further information.

The following cautions should be observed:

Defibrillation should be performed on the defibrillation electrodes only. If defibrillation is performed over any ECG or pacing electrode, high voltage may be present on the remaining connectors during the shock. This may also damage ECG and pacing circuitry.

To prevent overheating, do NOT provide more than three (3) defibrillator discharges (maximum 32 Joules) in a sequence. Do NOT exceed an average of two (2) defibrillator discharges per minute during the training session.

Do NOT let the mannequin come in contact with electrically conductive surfaces or objects during defibrillation. A flame-supporting atmosphere, for example, with a high content of oxygen, should be avoided during defibrillation.

Keep the mannequin chest dry. Special attention should be taken when using the urinary system or the chest tube feature.

To prevent pitting of the chest skin electrode, do NOT apply conductive gel or conductive defibrillation pads intended for patient use.

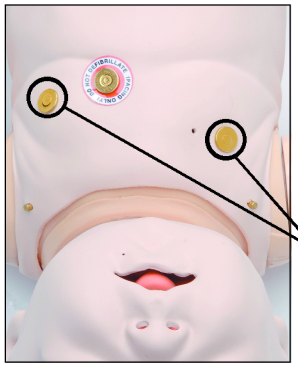
Do NOT use cables or connectors having visible damage.

Do NOT spill fluids over any component inside the mannequin torso. This could damage the system and may also present a possible hazard for the operator.

When using a manual defibrillator, the ECG can be monitored via the defibrillator paddles. Coarse ventricular fibrillation and high-rate ventricular tachycardia cardiac rhythms are automatically recognized as “shockable” rhythms.

With each defibrillation, the BabySIM automatically records the amount of energy discharged and the time defibrillation was performed. The simulated patient response to defibrillation is determined by the scenario script or instructor intervention. Thus, cardioversion is not automatically determined by the physiological models.

For paddle placement on the chest, the mannequin has two defibrillation disks, which can be unscrewed leaving threaded connections if required.



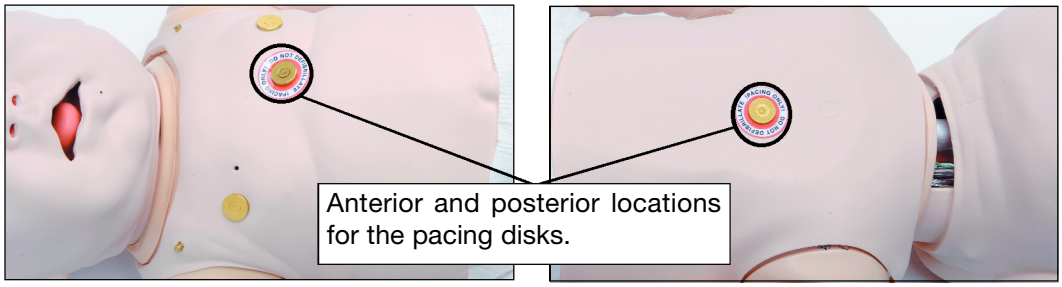
Defibrillation Disks

The BabySIM is compatible with a wide variety of manual defibrillators [1.77 inch (4.5 cm) rated for infants up to one year]. Defibrillators employing a monophasic waveform (as used by Physio-Control® equipment) and some biphasic difibrillators, such as those made by Zoll®, automatically report the energy discharge.

Do NOT allow defibrillator paddles to come in contact with pacing disks or ECG nodes. Defibrillating an ECG or pacing location will damage circuitry within the mannequin.

Pacing

Disks on the front and back of the mannequin are used for cardiac pacing. To use this feature, make sure the metal pacing disks are attached to the mannequin. Next, attach the pacing pads from a standard transthoracic cardiac pacer to the mannequin at the site of the pacing disks, the negative lead on the anterior location and the positive lead on the posterior location of the heart.



Pacing Disks

The software automatically detects and responds to pacing signals.

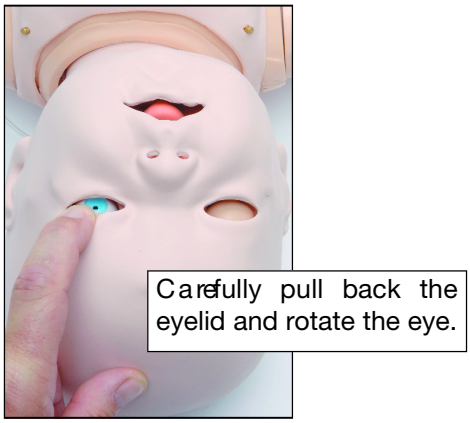
Trauma System

The mannequin can produce various trauma conditions using a combination of manual adjustments and software settings.

Trauma System			
Anatomy, Physiology, and Clinical Signs	**Clinical Interventions, Patient Monitoring, and Scenarios**	**Software Control**	**Manual Control**
Eye Signs	**Eye blinking and pupil size can be set independently for the left and right eye.**	Eye blinking can be set by the instructor. TAB: **Condition** SHOW: **Assessment** PARAMETERS: **Eyes:Blink Control** and **Eyes:Blink Speed** See pages 5.42 to 5.43	Manual adjustments for normal (3.5mm), blown (8 mm) and pinpoint (2mm) settings. See page 6.15, **Eye Sign Adjustment**.
Chest Tube Placement	**Chest tubes can be inserted into the mid-axillary line of the fifth intercostal space on the right. Suction equipment can be applied to withdraw fluid from the simulated intrapleural space.**	The instructor must adjust the amount of physiologic intrapleural fluid present. TAB: **Condition** SHOW: **Trauma** PARAMETER: **Intrapleural Volume** See page 5.47	See **Chest Tube Setup** on page 6.16.
Intraosseous Site	**Passive injection (with no drainage) can be made into the anterior tibia of the right leg.**	None required.	See **Intraosseous Site** on page 6.17.
Needle Decompression	**Decompression of a pneumothorax can be performed by inserting a needle at the mid-clavicular line of the second intercostal space on the right side.**	The instructor must adjust the amount of physiologic intrapleural air present. TAB: **Condition** SHOW: **Trauma** PARAMETER: **Needle Decompression** See page 5.48	See **Needle Decompression Setup** on page 6.17.
Secretions	**Body fluids can be excreted from the eyes, ears and mouth.**	None required.	See **Secretions** on page 6.18.

Eye Sign Adjustment

Each pupil of the BabySIM can be set independently to a fixed diameter of 2, 3.5 or 8 mm (pinpoint, normal or blown) by carefully lifting the eyelid and rotating the eye from left to right or right to left until the proper size appears.



Adjusting the Eyes

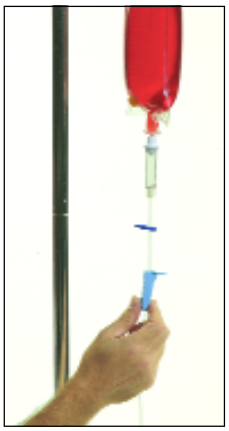
Additionally, eyelids can be programmed to open and close spontaneously or can be fixed in the closed position. When closed, a learner can manually open the eyelids for clinical inspection.

In the HPS software, the settings for the eyelids are located in the **Eyes: Blink Control** and **Eyes: Blink Speed** parameters accesed under **Assessment** in the **Condition** tab (see pages 5.42 and 5.43).

Chest Tube Setup

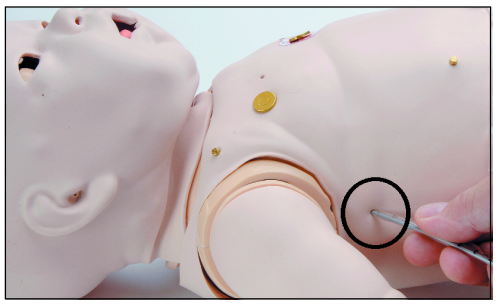
To use the chest tube feature:

1. Set up an IV pole near the PCU.
2. Fill an empty IV bag with the appropriate colored liquid (e.g. for simulated blood, mix distilled water with 5-cc of red food dye and fill the bag). Be careful not to make the mixture too thick as this can clog the system.
3. Attach the IV solution set to the IV bag and make sure the blue clamp is closed.
4. Hang the bag on an IV pole set up near the PCU.
5. Connect the hose from the IV solution set to the white Trauma Source hose in the Umbilical Assembly.



Simulated Blood

6. Once the hoses are connected, open the clamp and allow the fluid to flow into the mannequin. A reservoir inside the mannequin collects the fluid.
7. Insert a 10 to 12 Fr. chest tube (lubricated with silicone spray) into the insertion point at the mid-axillary line of the fifth intercostal space on the right side of the mannequin. The tube must be inserted far enough to engage the valve on the reservoir. The system is primed when water flows from the hose.

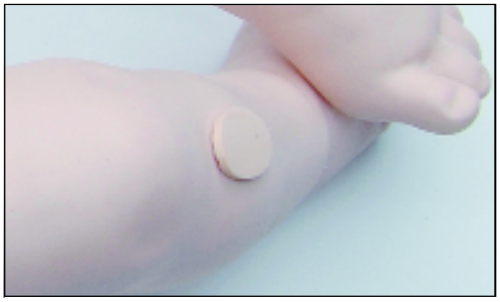


Chest Tube Insertion Point

8. Remove the chest tube if the procedure is to begin with chest tube insertion.

Intraosseous Site

The intraosseous site is located on the anterior tibia of the right leg.



The Intraosseous Site

After multiple injections into the site, the plug can be removed and replaced. A replacement plug is included with the Replacement Parts Kit.

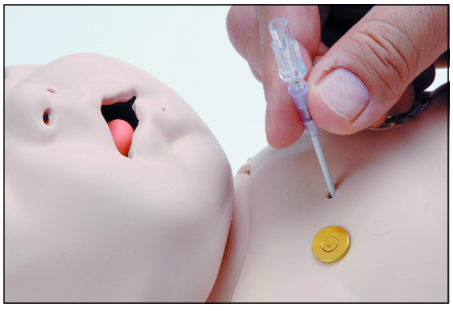
Needle Decompression Setup

To set up Pneumothorax Needle Decompression,

1. In the HPS software, go to the **Condition** tab and under **Trauma**, select **Needle Decompression**.

2. Click the **Enabled** button. After a few seconds, click the **Disabled** button. The momentary enabling of Needle Decompression allows air pressure into the mannequin's internal air reservoir, charging the reservoir. Once the air reservoir is filled, the system is primed and ready for a Pneumothorax puncture.

3. Insert the needle and (18 to 20 gauge) catheter into the small hole located in the mid-clavicular line of the second intercostal space. It is necessary to use a 3 to 6 cm long, 14-gauge needle directly into the mannequin until the hissing sound of the valve release is heard. If no sound is heard, the needle wasn't inserted properly (either in terms of depth or location).

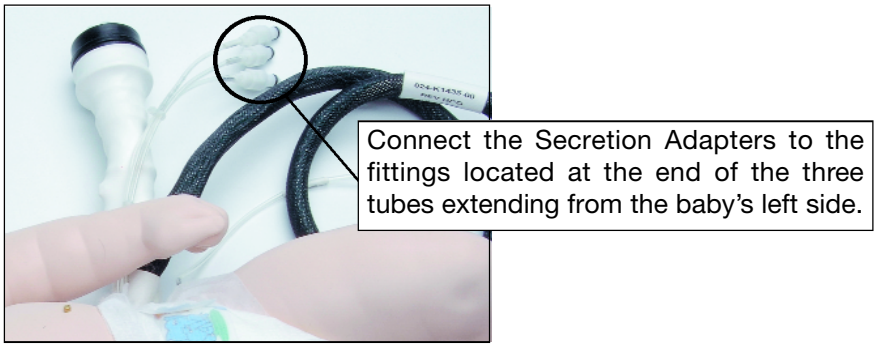


Needle Decompression

4. In the HPS software, adjust the **Right Intrapleural Volume** parameter located under **Lung** on the **Respiratory** tab (see page 5.77).

Secretions

Fluids can be excreted from the baby mannequin's eyes, ears and mouth using the three tubes extending from the left side of the baby.



The Secretions Connections

The fittings at the end of these tubes connect to the three Secretion Adapters included in the Replacement Parts Kit. The opposite end of the Secretion Adapter connects to either an IV bag for gravity flow secretions or to a syringe, which can be used to push fluid through the baby's eyes, ears and/or mouth.

When disconnected, a small valve in the fittings prevents leakage into the system.

Pharmacology System

The BabySIM supports pharmacological interventions through pre-programmed pharmacokinetic and pharmacodynamic parameters that are established for six intravenous drugs. A permanent access catheter is located in the left femoral vein.

Pharmacology System			
Anatomy, Physiology, and Clinical Signs	**Clinical Interventions, Patient Monitoring, and Scenarios**	**Software Control**	**Manual Control**
IV Medication Administration	**Bolus injections are administered utilizing standard syringes while continuous IV infusions can be administered using infusion devices. All physiological responses to medications are automatically calculated and exhibited on the patient mannequin.**	Administered IV medications must be set by the instructor. TAB: **Drugs** See pages 5.49 to 5.50	All administered IV medications are collected in the bag attached to the blue (IV Drain) hose.
IV Fluid Administration	**IV fluids can be administered in the permanent access catheter located at the left femoral vein.**	Administered IV fluids must be set by the instructor. TAB: **Fluids** PARAMETER: **Infusion** (Colloids, Crystalloids, Packed Red Blood Cells or Whole Blood) See pages 5.51 to 5.54	All administered IV fluids are collected in the bag attached to the blue (IV Drain) hose.

Medications and fluids are administered through the permanent access catheter located at the left femoral vein. Before using the access catheter, attach an empty bag to the blue hose (labeled IV drain) to collect those fluids introduced through the catheter.

Monitoring Patients

The Waveform Display Monitor provides a visual reading of key cardiovascular parameters. The display can be customized to suit the needs of a given scenario.

Waveform Display Parameters

There are eight parameters available that may displayed as waveforms in addition to providing their numeric values. An additional eight parameters are available for numeric display only.

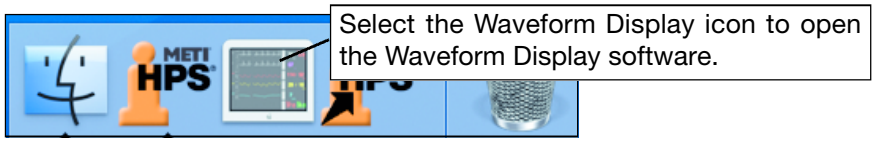
Waveform Display Parameters

Patient Parameter	Label	Waveform	Numeric
ECG Leads I, II, III	ECG I, II, III	✓	✓
Arterial Blood Pressure	ABP	✓	✓
Pulmonary Artery Pressure	PAP	✓	✓
Pulmonary Capillary Wedge Pressure	PCWP	✓	✓
Central Venous Pressure	CVP	✓	✓
Pulse Oximetry Plethysmogram	Pleth	✓	✓
Pulse/Heart Rate	Pulse		✓
Mean Arterial Pressure	MAP		✓
SpO_2	SpO_2		✓
Blood Temperature	Blood Temperature		✓
Body Temperature	Body Temperature		✓
Rectal Temperature	Rectal Temperature		✓
Axial Temperature	Axial Temperature		✓
Noninvasive Blood Pressure	NIBP		✓

Accessing the Waveform Display

If the Waveform Display Monitor has been correctly powered on (see page 3.14), the Waveform Display software automatically launches with the HPS6 software when login is completed for the Instructor Workstation (see page 4.1).

However, if the Waveform Display application has been closed or is not running, open the application by clicking on the Waveform Display icon located on the Dock.

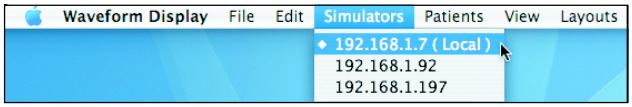


The Waveform Display Icon

When the Waveform Display opens, a blank screen appears and the Waveform Display menu is shown at the top of the window.

The Waveform Display with No Patient Selected

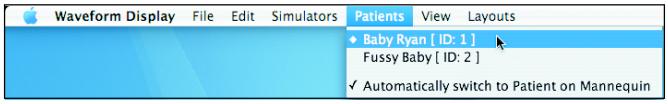
Beneath the menu bar, **No Patient Selected** should appear in the Waveform Display title bar. If **No Simulator Selected** appears, select the simulator from the **Simulators** menu.



Selecting a Simulator

In most cases, only one simulator will be available, located on the localhost.

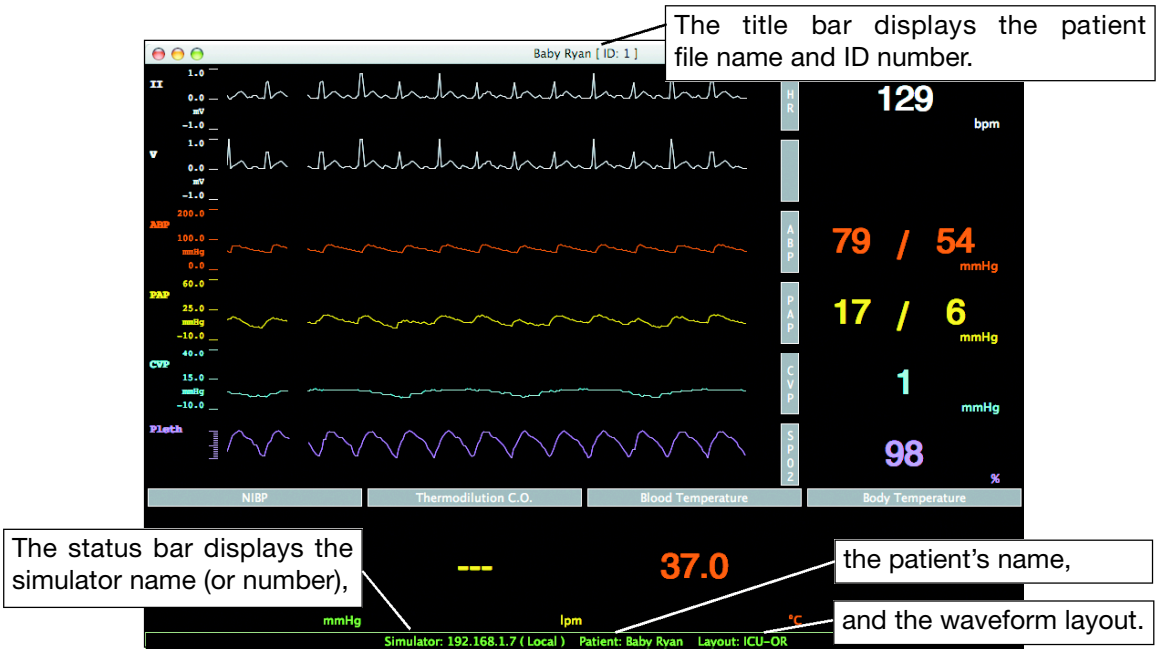
Once a simulator is chosen, select a patient from the **Patients** menu.



Selecting a Patient

The **Patients** menu contains a list of all patient files currently running. If no patient is running, open a patient file from the Patient Palette (see page 4.6).

The patient's information is loaded and displayed on the Waveform Display Monitor.



The Waveform Display with Patient Information

In the Waveform Display window, the patient's file name and ID number appears in the title bar at the top while the status bar at the bottom contains the simulator's identification, the patient's name, and the active waveform layout.

To change the patient, select a new name from the **Patients** menu.

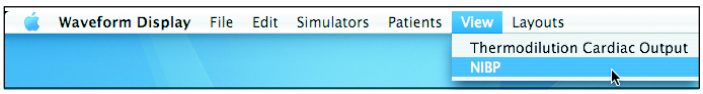
NOTE: By default, the option **Automatically switch to Patient on Mannequin** is selected. When this option is chosen and multiple patients are running, the waveform software automatically reflects the physiology of the active patient. However, because performance may be significantly affected, running multiple patients is not recommended.

Modifying the Waveform Display

The default configuration can be modified to change or customize the layout, suspend or reset alarms and change or mute the audio.

Viewing NIBP

Initially, the NIBP panel appears with no (--- / ---) value. To take an isolated reading of the noninvasive blood pressure at the current moment, select the **NIBP** option from the **View** menu.



Selecting NIBP to View

The NIBP reading appears in the NIBP panel and remains in view until another reading is taken.

Changing the Layout

The Waveform Display can show up to six waveform readouts with their accompanying numeric values plus an additional four numeric readouts.

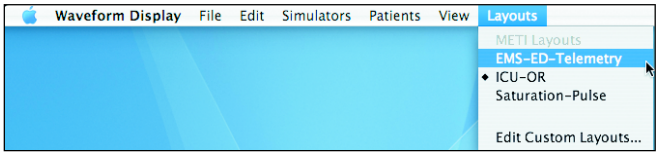
There are three preconfigured **METI Layouts**:

EMS-ED-Telemetry - preconfigured with a waveform and numeric readout for ECG Lead II and numeric readouts for SpO_2 and noninvasive blood pressure (NIBP).

ICU-OR (default layout) - preconfigured with waveform and numeric readouts for ECG Lead II, ECG Lead V (unused), ABP, PAP, CVP and Pleth, and numeric readouts for NIBP, Thermodilution C.O (unused), Blood Temperature and Body Temperature.

Saturation-Pulse - preconfigured with numeric readouts for SpO_2 and pulse.

Select the appropriate layout from the list located under the **Layouts** menu.



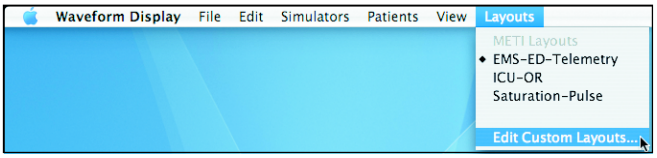
Selecting a Layout

Only the ICU-OR layout makes use of every parameter panel and the preconfigured layouts cannot be overwritten or changed, but any configuration of waveform/numeric and numeric values can be created by customizing the layout (see below).

When customized layouts are created, they appear in the **Layouts** menu beneath a **Custom Layouts** heading.

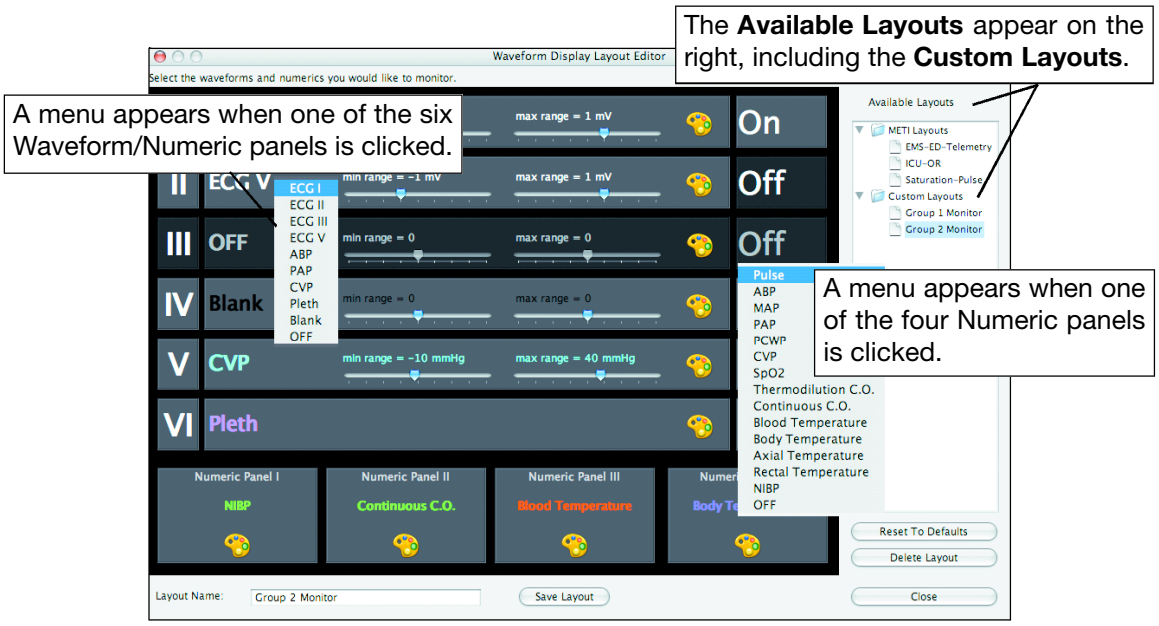
Customizing the Layout

To customize the Waveform Display layout, select the **Edit Custom Layouts** option from the **Layouts** menu.



Selecting Edit Custom Layouts

The Waveform Display Layout Editor appears, displaying the current layout. This layout can then be modified by selecting waveform/numeric or numeric parameters for the various panels.



The Waveform Display Layout Editor

To CHANGE the settings on a WAVEFORM/NUMERIC panel (one of the top six panels):

1. Click the panel to edit. A menu with ten options pops up.
2. Select the appropriate menu option:
    a. Select one of the cardiovascular-related options (**ECG V** is currently unavailable).
    b. Select **Blank** if the display is to leave an unused space for the panel.
    c. Select **OFF** if the display is to omit the panel, allowing additional space for the remaining waveform readouts.

3. Use the slider bars to adjust the minimum and maximum ranges for the readings.
4. Click the palette icon to the right of the panel to open a window with a color spectrum used to change the color of the waveform and numeric displays.
5. Click on the box on the far right to set the numerics to On or Off. (Waveform parameters set to the OFF position have numerics set to Off by default.)

To CHANGE the settings on a NUMERIC panel (one of the bottom four panels):

1. Click the panel to edit. A menu with fifteen options pops up.
2. Select the appropriate option:
    a. Select one of the cardiovascular-related options (**Thermodilution C.O.** is currently unavailable).
    b. Select **OFF** if the display is to darken the panel, leaving the space empty.
3. Click the palette icon at the bottom of the panel to open a window with a color spectrum used to change the color of the numeric display.

To CLEAR CHANGES, click the **Reset to Defaults** button on the lower right-hand side of the window.

When changes are complete, SAVE the new layout. (See page 6.26 for information on Saving a Customized Layout.)

CHANGES are LOST if the Waveform Display Layout Editor is closed without saving the new layout.

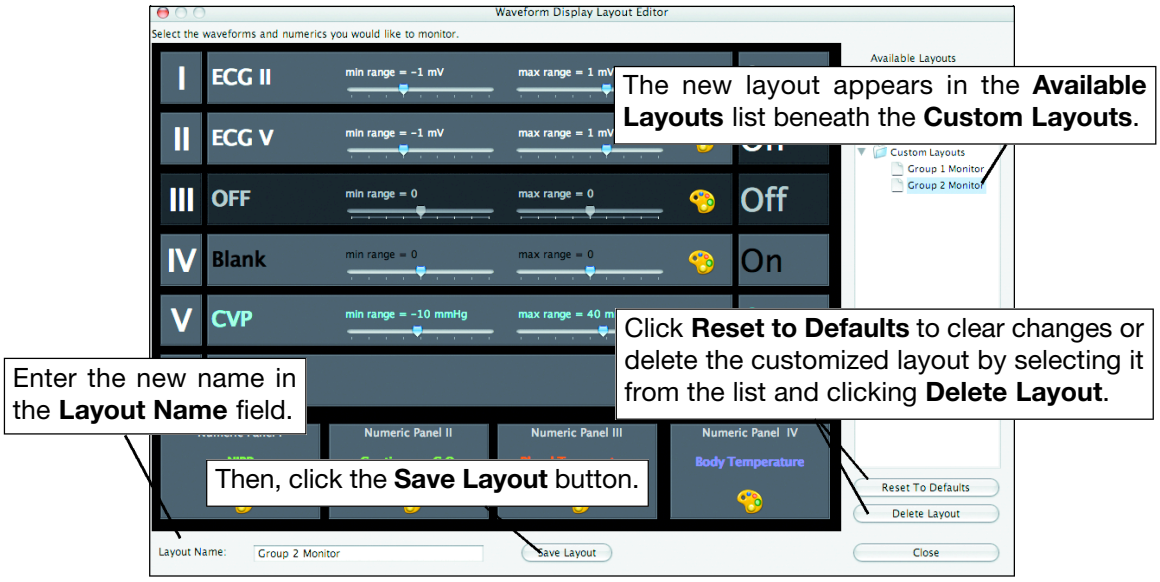
Saving a Customized Layout

To SAVE the new format once changes are complete:

1. Highlight the name in the **Layout Name** field.
2. Enter the name of the new layout.
3. Click the **Save Layout** button.

The customized layout now appears listed among the **Custom Layouts** in the **Available Layouts** panel on the right. This layout also appears in the **Layouts** menu.

Once changes have been saved, click the **Close** button to close the Waveform Display Layout Editor. The Waveform Display now displays the newly saved customized layout.



A Customized Layout for the Waveform Display

Deleting a Customized Layout

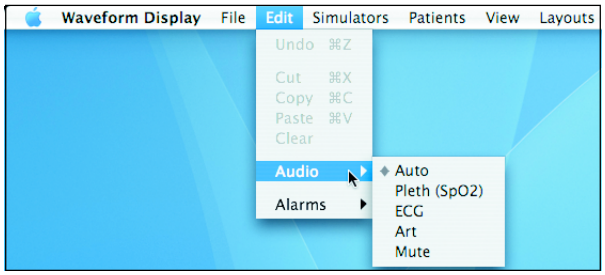
To DELETE a customized layout:

1. Select the layout from the list beneath **Custom Layouts** in the **Available Layouts** panel.
2. Click the **Delete Layout** button.

The customized layout is deleted.

Changing the Audio

The Waveform Display includes an audio feature with a choice of clinical monitoring sounds. To choose a setting, open the **Edit** menu and click **Audio** to access the sound options.



Selecting the Audio Menu

All settings are synchronized with the patient's heartbeat.

There are five available audio settings:

Auto (default) - depending on the layout, sounds are selected in order of these parameters: Pleth (SpO_2), ECG, and Art. If, for example, both Pleth and Art parameters are in the layout, the sounds related to the Pleth readout are heard. To hear the sounds of the Art readout when either the Pleth or ECG parameters are also present, the **Art** option must be chosen.

Pleth (SpO_2) - pitch changes according to the value of the SpO_2. When the SpO_2 value increases, the pitch becomes higher, and when the SpO_2 value decreases, the pitch becomes lower.

ECG - rate of sound reflects changes to the patient's heart rate while maintaining a constant unvarying pitch unaffected by the patient's condition.

Art - rate of sound reflects changes to the patient's Arterial Blood Pressure (Art) while maintaining a constant unvarying pitch unaffected by the patient's condition.

Mute - eliminates all sounds based on the patient's heartbeat. Does not remove any alarms set to sound when minimum and maximum levels of the layout's parameters are met.

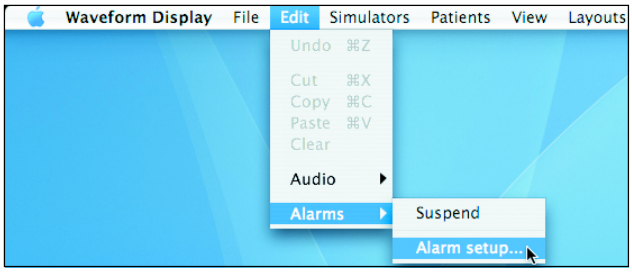
Choose the appropriate sound from the **Audio** menu.

Setting the Alarms

The Waveform Display includes an alarm feature that registers a two-tone (high-low) sound when patient parameter readings fall below or exceed a specified minimum or maximum setting. The alarm feature can be turned on (the default) or off by selecting the **Suspend** option from the **Alarms** menu located beneath **Edit** on the menu bar.

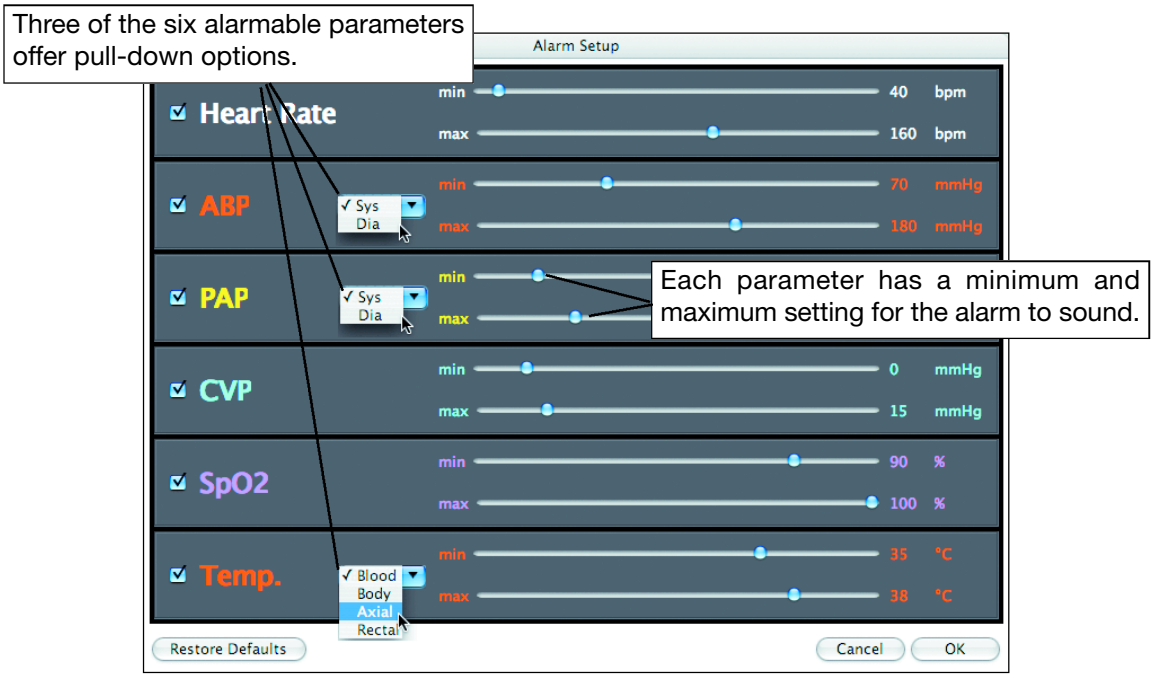
When alarms have been suspended, a diamond appears to the left of the option showing that **Suspend** has been selected.

The Alarm settings can also be modified. To change the settings for the alarms, select the **Alarm setup** option from the **Alarms** menu.



Selecting the Alarm Setup

The Alarm Setup window appears, displaying six parameters, three of which have pull-down menus.



The Alarm Setup Window

Including the pull-down settings, there are eleven parameters that may be associated with an alarm. However, only six alarm settings (one for each of the primary parameters displayed in the window) are possible at one time.

Alarm Settings					
Parameter	**Units**	**Default Maximum**	**Range**	**Default Minimum**	**Alarm Sound**
Heart Rate	BPM	250	40 to 60	30	Two-Tone/ High-Low
ABP (Sys)	mmHg	300	70 to 180	-40	Two-Tone/ High-Low
ABP (Dia)	mmHg	300	20 to 110	-40	Two-Tone/ High-Low
PAP (Sys)	mmHg	300	10 to 40	-40	Two-Tone/ High-Low
PAP (Dia)	mmHg	300	5 to 20	-40	Two-Tone/ High-Low
CVP	mmHg	300	0 to 15	-40	Two-Tone/ High-Low
SpO_2	%	100	90 to 100	50	Two-Tone/ High-Low
Temp (Blood)	°C	45	36 to 38	10	Two-Tone/ High-Low
Temp (Body)	°C	45	36 to 38	10	Two-Tone/ High-Low
Temp (Axial)	°C	45	36 to 38	10	Two-Tone/ High-Low
Temp (Rectal)	°C	45	36 to 38	10	Two-Tone/ High-Low

To set an alarm:

1. Check the box to the left of the parameter.
2. Choose an option from the pull-down menu, if available.
3. Use the slider bar to set the maximum and minimum levels.
4. Click the **OK** button.

To turn off a specific parameter's alarm, uncheck the box to left of that parameter and click **OK**.

To undo any changes, click the **Restore Defaults** button.

Using the Wireless Remote Control (OPTIONAL)

After the system is operational, the Wireless Remote Control laptop can be integrated into the simulator session.

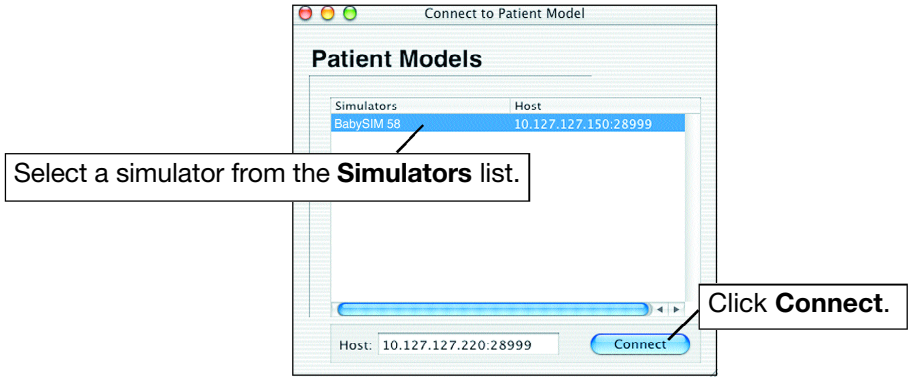
The HPS6 software must be running on the Instructor Workstation for the Wireless Remote to work. KEEP the cover of the Instructor Workstation OPEN. Closing the cover will terminate operations.

Turning on the Wireless Remote Control

To turn on the Wireless Remote Control

1. Power on the Wireless Remote by pressing the power button on the upper right-hand corner of the keyboard. If the HPS6 software does not launch automatically, click the HPS6 Launcher icon in the Dock.

The **Connect to Patient Model** window appears. (If the window fails to appear, select the **Connect to Patient Model** option from the **HPS** menu.



Connecting to the Patient Model

2. Select the simulator and click **Connect**.

3. Confirm the strength of the AirPort wireless signal by noting that 3 or 4 bars are present on the AirPort icon located toward the right of the HPS menu bar.

Confirming Signal Strength

The AirPort wireless signal range is approximately 150 feet.

Shutting Down the Wireless Remote Control

The Wireless Remote Control is shut down prior to the shutdown of the Instructor Workstation. Stop the patient file and quit HPS before powering down the remote laptop by choosing **Shut Down** from the Apple menu. (See page 4.11 for information on saving and stopping a patient file.)

BabySIM Care and Maintenance

Maintaining the METI BabySIM requires careful treatment of the electronic and mechanical components. Each time the BabySIM system is assembled or disassembled make sure all components are properly handled and either removed from or placed into storage correctly.

BabySIM® Warranty Programs

General Information

METI patient simulator products come with a one-year Basic Service Warranty at no additional charge. All warranties begin at date of shipment or METI installation. You may upgrade your first year Basic Service Warranty to an Enhanced Warranty and receive remedial and preventative maintenance. To prevent equipment downtime and delays after your warranty expires, we encourage you to contract for extended maintenance services for all subsequent years.

Units Out of Agreement

For units no longer under warranty requiring repairs, the Time and Materials service plan will apply (see **Time and Materials** section below).

To place an out-of-warranty unit under a warranty contract, METI reserves the right to have the patient simulator inspected by a METI-approved technician at the customer's expense. If necessary, the unit would have to be repaired at the customer's expense prior to issuance of a warranty contract.

The repairs required, as the result of the examination, will be quoted on a time and material basis.

How to Contact Customer Support

United States Office:

Toll Free (866) 462-7920
Direct (941) 342-5605
Fax (941) 342-5600
Internet Address: support@meti.com
Web URL: www.meti.com

US Military Office:

Phone (941) 379-1626
Fax (941) 379-1621
Internet Address: ljung@meti.com

European Office:

Phone +49-6131-971-3546
Internet Address: international_support@meti.com

Australian Office:

Phone +31-625-542873
Internet Address: jbankuti@meti.com

Canadian Office:

Phone (888) 516-9199
Internet Address: lchmielewski@stars.ca

Service Hours

The principal period for performance of service is:

United States Office:

Monday through Friday
7:00 AM to 6:00 PM,
Eastern Standard Time

European Office:

Monday through Friday
8:00 AM to 5:00 PM,
Central European Time

Canadian Office:

Monday through Friday
8:00 AM to 5:00 PM,
Mountain Standard Time

Australian Office:

Monday through Friday
8:00 AM to 5:00 PM,
Australian Eastern Standard Time

Holiday and non-business days are excluded.

Contract Period

Warranty contracts are not ordinarily offered for periods of less than one year. However, multiple-year warranty contracts may be arranged for up to an additional three years. Discounts are available for purchase of multiple year contracts.

Limitations of Agreement

Your exclusive remedy for any defective patient simulator is limited to the repair or replacement of the defective patient simulator.

METI may elect which remedy or combination of remedies to provide at its sole discretion. METI shall have a reasonable time after determining that a defective product exists to repair or replace defective product. METI's replacement product will be manufactured from new and/or serviceable parts. METI's agreement applies to repaired or replaced products for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced product, whichever is longer.

METI shall not be liable under this warranty for incidental or consequential damages, or in the event of any unauthorized repairs or modifications have been made or attempted, or when the product, or any part thereof, has been damaged by accident, misuse or abuse. This warranty does not cover normal wear and tear, staining, discoloration or other cosmetic irregularities that do not impede or degrade product performance. Any damage or malfunction as a result of the installation of software or hardware, not authorized by METI, will be repaired under the Time and Materials service plan (see **Time and Materials** section below).

METI's warranty does not cover products that have been received improperly packaged, altered or physically damaged. Products will be inspected upon receipt.

Some states in the USA do not allow the exclusion or limitations of incidental or consequential damages, so the limitations above may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

Return Materials Authorization (RMA)

No product may be returned directly to METI without first contacting METI for an RMA number. If it is determined that the product may be defective, you will be given an RMA number and instructions for product return. An unauthorized return, i.e. one for which an RMA number has not been issued, will be returned at your expense. Authorized shipments are to be shipped prepaid to the address on the RMA. Your original box and packaging materials should be kept for storing or shipping your product. To request an RMA, please contact Customer Service.

Basic Warranty Service Program

The METI patient simulator comes with a one-year Basic Warranty Service Program. The Basic Warranty Service Program provides return-to-factory hardware and software maintenance. Basic service provides corrective maintenance support for the timely repair or replacement of METI products. METI may either repair or replace failed components. The Basic Warranty Service option includes:

- Labor and materials for the repair of METI products at METI's facility.
- Timely replacement of faulty modules/sub-modules.
- Software upgrade services (see **System Software Upgrades Support** section).
- Basic application support.
- Customer Service Hotline (telephone, fax and e-mail).
- On-site repair provided at METI discretion.
- Freight costs to the METI center are not covered. However, METI bears the return freight costs utilizing a standard delivery service selected by METI.
- METI assumes the responsibility for loss or damage of goods in METI's Sarasota Facility during maintenance or service.

Enhanced Warranty Service Program

The Enhanced Warranty Service Program provides the same features as the Basic Warranty Service Program with the addition of Preventative Maintenance (PM) of METI products. PM takes place at METI’s facility and is performed once per year. Freight costs to and from the customer site, shipped by standard ground transportation, will be paid by METI. Preventative Maintenance consists of evaluation and performance testing of the following:

- Physical inspection and cleaning.
- Functional check of equipment.
- Lung calibration.
- Calibration of METI-produced equipment.
- Pneumatic adjustments as necessary.
- Electrical checks and adjustments as applicable.
- Mechanical inspection and adjustments.
- Repairs / alignments as necessary.

System Software Upgrade Support

Customers with current warranty contracts are entitled to receive upgrades to applications software previously purchased. Installation of the system software is the user's responsibility.

The System Software Upgrades Support includes software upgrades for base software and purchased optional software modules.

This does not apply for major upgrades or technological enhancements.*

Pricing Structure

Time and Materials

For those institutions not under agreement, service will be provided as required on a Time and Material basis:

Description	In-House	On-Site
Technical Support	As quoted at time of repair	$145 per hour Minimum 4 hours
Material	As quoted at time of repair	As quoted at time of repair
Travel	N/A	Priced at METI's fully burdened cost plus fee

Principal period of on-site support (customer's local time) is:

- Monday through Friday, 8:00 AM to 5:00 PM (customer's time zone)
- Holiday and non-business days excluded
- Support outside the principle period is billed at the premium rate (hourly rate x 1.5)

A minimum of 48 hours notice is required for scheduling an on-site support call. Urgent on-site support with less that 48 hours notice will be charged at the premium hourly rate.

On-site time is described as the time period commencing from arrival at customer site through departure from customer site.

Breakdown

After each use, the BabySIM should be properly disassembled, cleaned and stored in a secure place. To ensure that the BabySIM remains in good working condition, follow the prescribed METI breakdown procedures below. These procedures are estimated to take less than 30 minutes.

The table below outlines the steps required for disassembling, cleaning and storing the BabySIM system.

	Breakdown Steps
1	Clean Systems
1a	Flush Genitourinary (GU) System
1b	Flush IV System
1c	Flush Chest Tube System
1d	Decompress the Chest
1e	Wipe Off Mannequin
2	Turn the Air and Gas Supplies Off
3	Shut Down the Software
4	Disconnect the Computer Components
5	Shut Down the PCU
6	Disconnect Hoses and Cables from the PCU
7	Ready the PCU for Storage
8	Disconnect the Umbilical from the Mannequin
9	Store the Mannequin

Further details for each of these steps are included in the pages that follow.

Step 1: Clean Systems

To maintain the BabySIM in top condition, thoroughly clean the outside and flush those systems that were used during the session.

A. Flush Genitourinary (GU) System

If distilled or sterile water was not used during the simulation exercise, flush the system with at least 1-liter of distilled or sterile water.

To flush the GU system,

1. Replace the GU source IV bag with a 1 liter IV bag of distilled or sterile water.
2. Prime the the bulb of the IV stake and ensure that flow has started.
3. Run the IV supply of distilled or sterile water until the bag is empty.
4. Close the clamp on the GU source IV bag.
5. Remove the IV bag from the stake set and disconnect the stake set from the GU fitting on the Umbilical Assembly.
6. Drain the Umbilical Assembly and the stake set.
7. Connect a large (e.g. 60 cc) syringe filled with air to the orange hose (the GU fitting) of the Umbilical Assembly.
8. Using the syringe, force the air through the system until no water remains in the system.
9. Disconnect and drain the urine collection bag.

After the flushing procedure is completed, make sure the mannequin's skin is clean and dry.

To prevent mold, mildew and fungus from fouling the GU, occasionally flush the GU system with a 1 liter IV bag of distilled or sterile water mixed with 20 cc of bleach. Follow the procedure outlined above for flushing the system first using the beach solution. Repeat the procedure using distilled or sterile water only. The system should be cleaned in this way about once every two months (or as appropriate).

B. Flush IV System

To flush the left femoral IV site,

1. Remove the IV source bag from the red hose in the Umbilical Assembly.
2. Fill a 60 cc syringe with air and insert the tip into the end of the red hose.
3. Force air through the hose until no moisture exists.
4. IF COLORED WATER WAS USED, Fill a 60 cc syringe with fresh distilled or sterile water.
5. Insert the tip of the syringe into the red hose.
6. Inject all the water from the syringe into the hose and let it collect in the drain bag attached to the blue hose.
7. Continue to inject water until the water flowing into the bag is clear.
8. Refill the syringe with air and force the air through the hose until no moisture exists.

C. Flush Chest Tube System

To flush the Chest Tube system,

1. Disconnect the Trauma source bag from the white hose in the Umbilical Assembly.
2. Lubricate the priming tube with silicone spray.
3. Push the priming tube into the insertion site on the right side (if not already present) far enough to engage the valve and allow the water to drain out.
4. IF COLORED WATER WAS USED, fill a 60 cc syringe with fresh distilled or sterile water.
5. Insert the tip of the syringe into the end of the white hose.
6. Inject all the water from the syringe into the hose and let it drain out through the tube.
7. Repeat this process until the water draining through the tube is clear.
8. Fill the syringe with air and, inserting the syringe into the white hose, force the air through the system until no water drains from the tube.
9. Remove the tube.

D. Decompress the Chest

Always decompress the chest when using the Pneumothorax Needle Decompression feature before completing the shutdown procedures. Do not store the mannequin until decompression has been performed.

E. Wipe Off Mannequin

After all fluids have been removed, carefully inspect the mannequin for evidence of any remaining colored liquids. If a stain is found, use a soft cloth with mild soap to wash the area. Rinse and dry. Once the mannequin is thorough flushed and cleaned, it is ready for storage.

Step 2: Turn the Air and Gas Supplies Off

The first step in the breakdown process is to turn off any air or gas supply in use.

Turn off Air Supply

If air was used,

Shut off the air supply (i.e. the central air supply resource)

or

Turn off the OPTIONAL Air Compressor, drain any condensation and store the Compressor. The Quiet In-Room Air Compressor (introduced on page 2.13) is drained using a small plug at the one end. Remove the plug and tip the unit toward the opening to drain. Replace the plug after the procedure has been completed.

Turn off Gas Supply

If CO_2 was used,

Close the CO_2 supply using the supplied wrench to tighten the valve, and properly store the tank.

Once the air and gas supplies have been turned off, remove the Regulator Assembly from the CO_2 source, coil the assembly and set it aside for storage.

Step 3: Shut Down the Software

To shut down both the Waveform Display and HPS6 software:

1. In the HPS6 software, Click the **Disconnect** icon on the Patient window (see page 4.18 for more information on the **Connection Icons**).
2. From the Waveform Display software, select **Quit Waveform Display** from the **Waveform Display** menu.
3. If desired, click **Save** to save the patient file (see page 4.11 for information on the **Save** icon or page 4.25 to learn about **Saving Data**).
4. From the HPS6 software, click the **Stop** icon in the Patient window or Patient Palette (see page 4.11 for information on using the **Stop** icon). A warning box appears providing another opportunity to **Save** the patient file.
5. Select **Quit HPS** from the **HPS** menu.

If using a Wireless Remote Control, quit the HPS6 application using the same steps described above for the Instructor Workstation.

Step 4: Disconnect the Computer Components

To disconnect and store the computer components:

1. Power off the Waveform Display Monitor using the power button on the front of the monitor.
2. Power off the Instructor Workstation by selecting the **Shutdown** option beneath the menu on the Finder menu bar.
3. Unplug the Instructor Workstation and Waveform Display Monitor power cables from the outlet.
4. Disconnect the cable adapter (that is attached to the Waveform Display video cable) from the Instructor Workstation.
5. Remove the AC power cable and the video cable (with cable adapter attached) from the Waveform Display Monitor.
6. Disconnect the Ethernet cable from the Instructor Workstation.

7. Disconnect the power supply cable from the Instructor Workstation.
8. Coil the cords and store them along with the Waveform Display Monitor and Instructor Workstation.

If using the battery to power the Instructor Workstation or if using the Wireless Remote Control, recharge the battery using the power cable and a surge-protected power source. The Instructor Workstation and Wireless Remote Control both have a green light that indicates a fully charged unit, when lit.

Step 5: Shut Down the PCU

With the air and gas supplies turned off (from Step 1):

1. Power off the PCU by pressing the POWER SWITCH on the Interface Panel into the OFF position.
2. Unplug the power cord from the power outlet. (If using the OPTIONAL Auxiliary Power Supply, disconnect the cable from the Auxiliary Power Supply.)
3. Remove the power cord from the PCU port labeled AC IN. (If using the OPTIONAL Auxiliary Power Supply, remove the cable from the port labeled AUX POWER IN 12VDC.
4. Coil and set aside the power cord.

If using the Auxiliary Power Supply, recharge the internal battery by plugging the component into an AC power outlet when one becomes available.

Step 6: Disconnect the Hoses and Cables from the PCU

To disconnect the PCU's hoses and cables:

1. Disconnect the EXPIRED CO_2 hose connected to the PCU.
2. Disconnect the MAIN SUPPLY GAS AIR-OR-CO_2 hose.
3. Disconnect the Fluidic/Pneumatic Coupler from the lower UMBILICAL port.
4. Disconnect the Electrical cable from the upper UMBILICAL port.
5. Disconnect the Ethernet cable from the INSTRUCTOR WORK STATION port.
6. Coil the hoses and cables and set them aside to be stored.

Do NOT disconnect the umbilical from the BabySIM at this time. The hoses must be flushed through the simulator prior to disconnection.

Step 7: Ready the PCU for Storage

Once all of the hoses and cables are disconnected from the PCU Interface Panel, fold the Wireless Receiver antennas back into position and close the PCU door. Lock the clamps on all three sides of the PCU into place to ensure the safety of the equipment.

Step 8: Disconnect the Umbilical from the Mannequin

To disconnect the Umbilical Assembly from the mannequin,

1. Unlock the fluid/pneumatic hose system by pressing the red lever.
2. Disconnect the electrical cable by twisting the outer fitting.
3. Wind the umbilical carefully and set it aside to prepare it for storage.

Step 9: Store the Mannequin

Place the mannequin in the hard mannequin case for storage, using the foam inserts to hold it in place. Use any remaining room in the case for clinical supplies and other teaching tools used in the next session.

Before storing the wireless microphone, be sure the transmitter has been turned off to maintain battery power for the next session.

Maintenance Advice

Simple care and maintenance helps to ensure that the BabySIM system stays in good working condition. Many problems are caused by inadequate or improper maintenance. Perform a thorough check of the various components each time the simulator is used.

General Mannequin Care

- Avoid the use of writing instruments and sharp objects near the patient mannequin to prevent unattractive markings on or tears in the skin.
- A mild detergent and warm water will remove most marks and stains. Gently rub the soiled area with a soft cloth. Do NOT use ABRASIVE soaps or pads.
- If more stubborn markings appear on the mannequin, METI suggests a specialty cleaning product (such as Goof Off or Orange-Sol, available at home improvement or hardware stores). Following the manufacturer's practices and warnings when using these types of cleaners should allow for gentle and easy removal of the marks and stains.
- Prior to using moulage of any kind, METI suggests the application of a very light coating of petroleum jelly, followed by a light dusting of baby powder to the mannequin's skin. This application makes cleaning the skin easier. For cleanup, use alcohol and gauze or a gentle cleaning solvent (such as Goof Off® or Orange-Sol products).
- If any of the trauma, genitourinary or IV features of the BabySIM have been used, flush out the mannequin as described in the previous pages. Failure to flush the systems may cause problems for the system during attempts at future use.
- Store the mannequin in the hard case provided for storage and transport.
- Do NOT stack items on top of the mannequin case.

Airway Inspection

The BabySIM is equipped with an anatomically accurate airway which supports the practice of difficult airway management techniques. In the process of performing these techniques improperly or aggressively, the upper airway can be damaged. While such damage may be readily apparent (manifested as a "leak in the breathing circuit) during mechanical ventilation, it may not be obvious during spontaneous or bag and mask ventilation.

Because damage can occur, occasional visual inspection of the airway is recommended. Using the light of a laryngoscope blade or a flashlight, visually examine both the upper and lower airway. While tears in the upper airway resulting from intubation may be obvious, needle holes in the lower bronchus resulting from techniques such as transtracheal jet ventilation may not be readily apparent.

If damage to the airway is found, small cuts or tears may be reparable (see below). However, for permanent repair of damaged mannequins contact METI Customer Support.

Mannequin Repair (Cuts and Abrasions)

Perform the following steps if a cut occurs,

1. Clean the area around the cut thoroughly using alcohol swabs or liquid alcohol and cotton balls.
2. Allow the area to dry completely.
3. Apply a small bead of cyanoacrylate adhesive (e.g. Superglue™) to the open surfaces.
4. Wipe any excess glue away with an alcohol-coated cotton swab.
5. Firmly press the surfaces together taking great care not to touch the adhering area.

The following tips may be useful when completing the above procedure,

- The repaired area may be gently sanded using a fine grit paper.
- Disposable examination gloves are recommended to prevent inadvertent adhesion of skin.

Contact METI for permanent repair of damaged mannequins.

Care of Electronic Equipment

- Do NOT use any of the computer components associated with this system for any other use.
- Do NOT connect the computer components to any network of any kind.
- Install any METI software updates as soon as they become available.
- NEVER stack other equipment on computer components or the PCU.

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Increased ICP

Scenario Scene

This is a 5-month-old male brought by his mother to the Emergency Department after falling off the bed. He cried initially and then became lethargic. He had a brief episode of eye deviation and right arm jerking. The mother has had to stimulate him to keep him awake.

Past Medical History: Ex-premature infant, 29-week gestation and 1350 g. He was mechanically ventilated for 9 days and on oxygen for 15 days. Discharged home on no medications at 5 weeks and 2.3 kg.

Review of Systems:

CNS: Lethargy. Possible seizure episode.
Cardiovascular: Noncontributory
Pulmonary: Noncontributory.
Renal / Hepatic: Noncontributory
Endocrine: Noncontributory
Heme / Coag: No active bleeding

Current Medications: None

Physical Examination

General: Floppy, lethargic, pale infant responds minimally to painful stimulus

Weight, Height: 4.5 kg

Vital Signs: Temp 36.6°C, HR 109 / min, RR 28 / min., BP 105/78, SpO_2 98%

HEENT: No visible external signs of trauma, Anterior fontanel bulging, PERRL, Possible retinal hemorrhages, no nasal or ear drainage

Airway: Patent

Lungs: Clear

Heart: No murmur, capillary refill 3 seconds

Laboratory, Radiology, and other relevant studies: HCT 23%

Allergies: None as reported by mother

Learning Objectives

1. Recognize signs of intracranial hypertension in an infant.
2. Describe several etiologies for intracranial hypertension in the infant.
3. Recognize the importance of prompt airway management to maintain oxygenation and to prevent hypercapnia.
4. Understand and demonstrate management of head trauma and intracranial hypertension in the infant.
5. Effectively communicate with other members of the healthcare team.

Scenario States

State	Patient Status	Learning outcomes or actions desired
Baseline (Baby Ryan)	HR=129, BP 88/55 RR=40; Cardiac Rhythm=NSR; SpO_2=98%; Breath Sounds=clear; LOC=alert; PEARL	1. In each state, reassesses condition and response to treatment *Transition:* When the instructor is ready to start the scenario, click the next button.
Intracranial Hypertension	HR=108; BP=103/68; RR=32; Cardiac Rhythm=NSR SpO_2=98% on room air; Breath Sounds=clear LOC=Lethargic, responds minimally to painful stimuli; Weight=4.5 kg; PEARL; Anterior fontanel bulging; ICP=25 mmHg	1. Completes initial assessment, evaluates data collected, and documents 2. Initiates monitoring and interprets 3. Implements measures to decrease anxiety of parents 4. Establishes IV access *Transition:* If time in state >5 minutes go to Worsening ICP
Worsening ICP	HR=82; BP=110/64; RR=22; Cardiac Rhythm=Sinus Rhythm; Cheyne-Stokes respiratory pattern; LOC=Unresponsive; Right pupil blown; ICP=35 mmHg	1. Reassess, interprets findings, and documents 2. Continues to monitor oxygenation and neurological status 3. Recognizes worsening condition 4. Applies oxygen to maintain SpO_2 >95%. 5. Institutes measures to decrease ICP *Transition:* If Time in State > 3 minutes go to Respiratory Arrest
Respiratory Arrest	RR=0; Breath Sounds=absent bilaterally; Pupils blown bilaterally	1. Initiates PALS 2. Controls airway 3. Reassess, interprets findings, and documents 4. Maintains head neutral, slightly elevated once airway management completed *Transition:* Manual to Improved at instructor's discretion
Improved	RR=BV assisted ventilation; Breath Sounds=present bilaterally with assisted/ controlled ventilation; LOC=Unresponsive	1. Reassess, interprets findings, and documents 2. Establishes intravenous access 3. Gives isotonic fluid bolus of 20 mL/kg 4. Transitions care to a higher level 5. Calls report to admitting unit

Equipment/Supplies Needed

Body Substance Isolation/Standard Precaution Supplies

Airway: Oxygen, Infant Oxygen Mask (Medium and High Concentration), Self-inflating Bag, LMA Size 1.5, Endotracheal Tubes (Uncuffed Size 3.0, 3.5, 4,0 mm) and Stylet, Miller 1 Blade and Laryngoscope, Infant Airways, Suction

Equipment: Cardiac Monitor, Pulse Oximeter, PediCAP/$etCO_2$, NIBP, Flashlight

IV Supplies: IV Catheters (24 gauge Angiocath), Simulated 0.9% Saline IV Solution, IV Tubing, Tape

X-ray Films

Printed Lab Values

Run Report or Appropriate Forms for Documentation

References

Instructor's Notes:
This scenario was created with "Baby Ryan." Other patients may be used, but the physiology will be different than what appears on this simulation card.

References:

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Increased ICP

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Infant Shock

Scenario Scene

This is a 3-month-old male brought to his pediatrician for fever, diarrhea and vomiting and poor oral intake. Mom and Dad state he has had 24 hours of watery diarrhea and vomiting (nonbilious). This afternoon he developed tactile fever and refused oral intake. He is tachycardic, mottled and listless. The pediatrician immediately transports the infant to the hospital ED across the street from her office.

Past Medical History: Healthy up to 24 hours ago. Immunizations up to date.

Past Surgical/Anesthetic History: None

Review of Systems:

CNS: Listless, poor oral intake, no seizures
Cardiovascular: None
Pulmonary: Noncontributory
GI: Non-bloody watery diarrhea, greater than 10 stools today. Emesis. No jaundice.
Renal / Hepatic: unknown if he has voided, mixed with stool in diaper.
Endocrine: None
Heme / Coag:None

Current Medications: None

Physical Examination

General: Pale, mottled, listless

Weight: 6.7 kg

Vital Signs: Temp 39.3°C, HR 198 / min, RR 67 / min BP 58/48, SpO_2 93% room air, improves to 97% with blow by oxygen

Skin: Maculopapular rash chest and abdomen

HEENT: Fontanel flat (sunken), PERRL, Tympanic membranes red and bulging, no nasal discharge, mucous membranes dry

Airway: Patent, normal infant

Lungs: Quiet tachypnea, clear

Heart: Tachycardic, cold extremities below knees, capillary refill time 6 seconds

Abdomen: Soft, mild diffusely tender, slightly distended, hyperactive bowel sounds, liver 2 cm below right costal margin

Laboratory, Radiology, and other relevant studies: HCT 34%, WBC 16.7 with 53 segs, 18 bands, 23 lymphs, 6 mono

Platelet: 114,000

Chem 10: Na 129, K 5.6, CL 97, HCO_3 15, BUN 41, Cr 1.2, Ca 7.9, Mg 1.6, PO_4 4.3

ABG: 7.32, $PaCO_2$ 27, PaO_2 78

Chest radiograph: Normal cardiac silhouette, clear lung fields

Allergies: None as reported by mother

Learning Objectives

1. Recognize the manifestations of shock in the infant.
2. Describe common etiologies for shock in the infant: hypovolemic, septic, cardiogenic.
3. Develop a treatment plan for infant shock including fluid management, vasopressors, and other medications such as corticosteroids.
4. Understand the requirement for rapid institution of intravenous access including interosseus infusion.
5. Effectively communicate with other members of the healthcare team.

Scenario States

State	Patient Status	Learning outcomes or actions desired
Baseline (Baby Ryan)	HR=129; BP=88/5; RR=40; Cardiac Rhythm=NSR; SpO_2=98%; Breath Sounds=clear; LOC=alert; PEARL	1. In each state, reassesses condition and response to treatment *Transition:* When the instructor is ready to start the scenario, click the next button.
Shock	HR=98; BP=57/46; RR 67; Cardiac Rhythm=Sinus Tachycardia; SpO_2=93% on room air and improves to 97% with blow by oxygen; Breath Sounds=clear; Temp=39.3°C; LOC=listless, responds to painful stimuli; PEARL; Anterior fontanel sunken	1. Completes initial assessment, evaluates data collected, and documents 2. Initiates monitoring and interprets 3. Initiates oxygen therapy to keep SpO_2>95% 4. Implement measures to decrease anxiety of parents 5. Establishes IV access *Transition:* If time in state >3 minutes to to Worsening Shock
Worsening Shock	HR= 220; BP=52/39; RR=70; LOC-nonresponsive	1. Reassess, interprets findings, and documents 2. Continues to monitor oxygenation and neurological status 3. Recognizes worsening condition. 4. Considers fluid bolus 5. Considers vasopressor therapy to maintain SBP >60 mmHg *Transitions:* If time in state >5 minutes go to Cardiopulmonary Failure If crystalloid infusion >120 mL go to Improved AND If dopamine infusion started at >5 mcg/kg/minute go to Improved
Cardiopulmonary Failure	HR=72; BP=47/29; RR=10; Breath Sounds=diminished bilaterally	1. Initiates PALS 2. Controls airway 3. Reassess, interprets findings, and documents 4. Considers fluid bolus 5. Considers vasopressor therapy to maintain SBP >60 mmHg *Transition:* If crystalloid infusion >120 mL go AND If dopamine infusion started at >5 mcg/kg/minute go to Improved
Improved	HR 140; BP 82/50; RR 40 Breath Sounds=present bilaterally; LOC=Responsive to painful stimuli	1. Reassess, interprets findings, and documents 2. Transitions care to a higher level 3. Calls report to admitting unit

Equipment/Supplies Needed

Body Substance Isolation/Standard Precaution Supplies

Airway: Oxygen, Infant Oxygen Mask (Medium and High Concentration), Self-Inflating Bag, LMA Size 1.5, Endotracheal Tubes (Uncuffed Size 3.0, 3.5, 4,0 mm) and Stylet, Miller 1 Blade and Laryngoscope, Infant airways, Suction

Equipment: Cardiac Monitor, Pulse Oximeter, PediCAP/$etCO_2$, NIBP, Flashlight

IV Supplies: IV Catheters (24 gauge Angiocath), Interosseus Needle, Simulated 0.9% Saline IV Solution, IV Tubing, Tape

X-ray Films

Printed Lab Values

Run Report or Appropriate Forms for Documentation

References

Instructor's Notes:
This scenario was created with "Baby Ryan." Other patients may be used, but the physiology will be different than what appears on this simulation card.

References:
Han YY, Carcillo JA, Dragotta MA, Bills DM, Watson RS, Westerman ME, Orr RA. *Early reversal of pediatric-neonatal septic shock by community physicians is associated with improved outcome.* Pediatrics. 2003. 112: 793-9.

Thomas NJ and Carcillo JA. *Hypovolemic shock in pediatric patients.* New Horizons. 1998; 6:120-9.

Infant Shock

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RSV Bronchiolitis

Scenario Scene

This is a 4-month-old female brought to the hospital for coughing and wheezing. She has had a runny nose and low-grade fever for 2 days. Her physician who prescribed Dimetapp elixir and acetaminophen evaluated her yesterday. She is not breast feeding well and refused pedialyte.

Past Medical History: She has a past history of prematurity, born at 32 weeks gestation and 2100 grams. Discharged after a 2-week hospitalization.

Past Surgical / Anesthetic History: Inguinal hernia repair at 4 weeks of age

Review of Systems:

CNS: Fussy, poor appetite
Cardiovascular: Noncontributory
Pulmonary: Tachypnea, cough, yellowish nasal discharge
Renal / Hepatic: Noncontributory
Endocrine: Noncontributory
Heme / Coag: Noncontributory

Current Medications: Dimetapp elixir and Acetaminophen

Family/ Social History: 3-year-old brother has URI and cough.
Immunizations: DTaP / IPV/ Hib / PCV / Hep B (2);
No RSV prophylaxis. No tobacco exposure

Physical Examination

General: Alert, female infant with frequent cough; Fussy, but consolable

Weight, Height: 4.9 kg

Vital Signs: Temp 38.1°C; HR 171 / min; RR 67 / min; BP 65/47; SpO_2 89% room air, improves to 94% with simple O_2 mask

HEENT: Fontanel flat, yellow nasal discharge, Tympanic membranes translucent, pink and mobile. PEARL

Airway: Normal infant, patent

Lungs: Nasal flaring, mild head bobbing, intercostals and substernal retractions; Bilateral equal breath sounds decreased at bases; bilateral wheezing, expiratory phase prolonged

Heart: RRR, S_2 normal, no murmur, capillary refill time 3 seconds

Abdomen: Soft, non-tender, healed surgical scar right groin

Laboratory, Radiology, and other relevant studies:
HCT 33%
WBC 11.9

Chest radiograph: Bilateral hyperinflation, right upper lobe atelectasis, increased perihilar markings; RSV nasal rapid test positive

Allergies: None as reported by mother

Learning Objectives

1. Recognize signs of respiratory distress in the infant.
2. Understand the etiologies of wheezing and bronchiolitis in the infant.
3. Recognize the pulmonary manifestations of respiratory syncytial virus (apnea, bronchiolitis or pneumonia).
4. Describe the treatment options for RSV bronchiolitis including the use of bronchodilators, corticosteroids and the timing of instituting mechanical ventilation.
5. Effectively communicate with other members of the healthcare team.

Scenario States

State	Patient Status	Learning outcomes or actions desired
Baseline (Baby Ryan)	HR=129; BP=88/55; RR=40; Cardiac Rhythm=NSR; SpO_2=98%; Breath Sounds=clear; LOC=alert; PEARL	1. In each state, reassesses condition and response to treatment *Transition:* When the instructor is ready to start the scenario, click the next button.
Respiratory Distress	HR=170; BP=68/42; RR=66; Breath sounds=wheezing bilaterally; SpO_2=88%; LOC=alert; Anterior fontanel flat	1. Reassess, interprets findings, and documents 2. Initiates oxygen therapy to maintain SpO_2 >90% 3. Continues to monitor oxygenation and neurological status 4. Recognizes worsening condition 5. Considers fluid bolus *Transition:* If time in State >5 minutes go to Worsening Respiratory Distress
Worsening Respiratory Distress	HR=180's; BP 95/72; RR 76; SpO_2=82% on room air and increases to 92% on 100% oxygen mask	1. Reassess, interprets findings, and documents 2. Considers bronchodilator therapy (albuterol or levalbuterol) *Transition:* Manual transition when instructor ready to go to Bronchodilator Responsive or Respiratory Arrest
Bronchodilator Responsive	HR=160; BP=82/50; RR=46; SpO_2=95-97% with 100% oxygen mask; Breath Sounds=crackles bilaterally	1. Reassess, interprets findings, and documents 2. Transitions care to a higher level 3. Calls report to admitting unit
Respiratory Arrest	HR=92; RR=12; SpO_2=78-83% on 100% oxygen mask; LOC=unresponsive	1. Initiates PALS 2. Reassess, interprets findings, and documents 3. Transitions care to a higher level 4. Calls report to admitting unit

Equipment/Supplies Needed

Body Substance Isolation/Standard Precaution Supplies

Airway: Oxygen, Infant Oxygen Mask (Medium and High Concentration), Self-inflating Bag, LMA Size 1.5, Endotracheal Tubes (Uncuffed Size 3.0, 3.5, 4,0 mm) and Stylet, Miller 1 Blade and Laryngoscope, Infant Airways, Suction

Equipment: Cardiac Monitor, Pulse Oximeter, PediCAP/$etCO_2$, NIBP

IV Supplies: IV Catheters (24 gauge Angiocath), Simulated 0.9% Saline IV Solution, IV Tubing, Tape

X-ray Films

Printed Lab Values

Run Report or Appropriate Forms for Documentation

References

Instructor's Notes:
This scenario was created with "Baby Ryan." Other patients may be used, but the physiology will be different than what appears on this simulation card.

References:

Black CP. *Systematic review of the biology and medical management of respiratory syncytial virus infection.* Respiratory Care. 2003. 48: 209-31;

Davison C, Ventre KM, Luchetti M, Randolph AG. *Efficacy of interventions for bronchiolitis in critically ill infants: a systematic review and meta-analysis.* Pediatric Critical Care Medicine. 2004. 5:482-9.

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RSV Bronchiolitis

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Sedation Induced Apnea

Scenario Scene

This is a 6-month old male with cystic fibrosis. You are called urgently to the patient's room because the pulse oximeter oxygen saturation has dropped into the low 80's and the infant is less active. He just returned from the treatment room where a PICC line was inserted under conscious sedation. The patient's nurse had flushed the IV injection port just before the event. Fentanyl and midazolam were administered into the injection port during the sedation.

Past Medical History: Cystic fibrosis, mild lung disease.

Past Surgical / Anesthetic History: Exploratory laparotomy for meconium ileus, DOL 1

Current Medications: Vancomycin, ceftriaxone, Vitamins (A, D, E, K), Pancreatic enzymes

Physical Examination

General: Unresponsive, cyanotic lips and nail beds

Weight: 7.8 kg

Vital Signs: Temp 36.5°C, HR 116 / minute, RR 8 / minute, BP 88/64, $Sp0_2$ 84%

Airway: Normal appearing infant

Lungs: Suprasternal retractions, paradoxical respirations, decreased breath sounds bilaterally, no wheezes. Some crackles bilaterally

Heart: RRR no murmur

Laboratory, Radiology, and other relevant studies: None

Allergies: None

Learning Objectives

1. Recognize apnea and its manifestations.
2. Identifies the etiologies of apnea.
3. Describe treatments for sedation-induced apnea including various airway management techniques and antagonist therapies (naloxone, flumazenil).
4. Effectively communicate with other members of the healthcare team.

Scenario States

State	Patient Status	Learning outcomes or actions desired
Baseline (Baby Ryan)	HR=129; BP=88/55; RR=40; Cardiac Rhythm=NSR; SpO_2=98%; Breath Sounds=clear; LOC=alert; PEARL	1. In each state, reassesses condition and response to treatment *Transition:* When the instructor is ready to start the scenario, click the next button.
Opioid Induced Apnea/UAO	HR=116; BP 68/42; RR 8; Breath sounds=crackles bilaterally; SpO_2=84%; Temp=36.5°C; LOC-unresponsive; Pupils pinpoint bilaterally; Weight=7.8 kg; Laryngospasm on	1. Assess, interprets findings, and documents 2. Initiates oxygen therapy to maintain SpO_2 >90% 3. Controls airway 4. Continues to monitor oxygenation and neurological status 5. Recognizes worsening condition 6. Considers antagonist administration *Transition:* Manual transition to Improved once antagonist administered Manual transition to Airway Insertion upon discretion of instructor
Airway Insertion	Laryngospasm off	1. Reassess, interprets findings, and documents 2. Controls airway *Transition:* Manual transition to Improved once antagonist administered
Improved	HR=120; BP=82/50; RR=40; SpO_2=98% on room air; Breath Sounds=crackles bilaterally; LOC=alert; PEARL 4 mm bilaterally	1. Reassess, interprets findings, and documents

Equipment/Supplies Needed

Body Substance Isolation/Standard Precaution Supplies

Airway: Oxygen, Infant Oxygen Mask (Medium and High Concentration), Self-inflating Bag, Miller 1 Blade and Laryngoscope, LMA size 1.5, Endotracheal Tube (Uncuffed Size 3.0, 3.5, 4.0 mm) and Stylet, Infant Airway

Equipment: Cardiac Monitor, Pulse Oximeter, NIBP and PediCAP/$etCO_2$

IV Supplies: Has PICC, Simulated IV Fluid and Tubing

X-ray Films

Printed Lab Values

Run Report or Appropriate Forms for Documentation

References

Instructor's Notes:
This scenario was created with "Baby Ryan." Other patients may be used, but the physiology will be different than what appears on this simulation card.

References:
Gozal D. *New concepts in abnormalities of respiratory control in children.* Current Opinions Pediatrics. 2004. 16:305-8.

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Sedation Induced Apnea

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