Cyber Physiology™ :SimBioSys™

Models the way a real patient's physiology responds to real interventions.

The world's most realistic physiology education system Cyber Physiology™: SimBioSys™ is a comprehensive software for simulating human physiology for learning. The software offers learning at both the medical and introductory levels, and includes interactive real-time simulations, animations, illustrations, and quizzing mechanisms within an interactive environment.

The SimBioSys™ engine is based on over **240 Differential Equations**, and has over **1000 parameters**. The underlying models include cardiovascular, circulatory, respiratory, and renal systems coupled to a vascular system and peripheral organs, all of which are coordinated by the central nervous system.

www.Cyber - Anatomy.com

Electronic Textbook Content

Chapter 1: Membrane Physiology
- Ex. 1: Diffusion in a Free Fluid
- Ex. 2: Diffusion across a Membrane

Chapter 2: Cellular Excitability
- Ex. 1: Nernst Equation
- Ex. 2: Determinants Rst. Memb. Pot.
- Ex. 3: Action Potentials

Chapter 3: Cell Signaling
- Ex. 1: Dose Response Curves
- Ex. 2: Competitive and Noncompetitive Antagonists
- Ex. 3: Epinephrine and Propranolol

Chapter 4: Muscle Contraction
- Ex. 1: The Length-Tension Relationship

Chapter 5: Pressure and Flow
- Ex. 1: Systemic Vascular Resistance
- Ex. 2: Pulmonary Vascular Resistance

Chapter 6: Cardiac Excitation
- Ex. 1: AV Nodal Conduction
- Ex. 2: Automaticity
- Exercise 3: Rhythms

Chapter 7: The Cardiac Cycle
- Ex. 1: Ventricular Ejection
- Ex. 2: Ventricular Filling
- Ex. 3: Aortic Stenosis
- Ex. 4: Aortic Regurgitation

Chapter 8: Cardiac Pressure Volume Relationships
- Ex. 1: Diastolic PV Relationships
- Ex. 2: Cardiac Preload
- Ex. 3: Cardiac Afterload
- Ex. 4: Systolic PV Relationships
- Ex. 5: Measuring Contractility
- Ex. 6: Heart Rate

Chapter 9: Control of Circulation
- Ex. 1: Circulatory Pause
- Ex. 2: Hemorrhage
- Ex. 3: Tamponade
- Ex. 4: Dobutamine

Chapter 10: Autonomic Control
- Ex. 1: Parasympathetic Tone
- Ex. 2: Sympathetic Tone
- Ex. 3: Hemorrhage
- Ex. 4: Ganglionic Blockade

Chapter 11: Blood Gas Exchange
- Ex. 1: Altitude
- Ex. 2: Respiratory Quotient
- Ex. 3: Hemoglobin Oxygen Dissociation
- Ex. 4: CO2 Content
- Ex. 5: Arterial and Venous Blood

Chapter 12: Systemic Oxygen Transport
- Ex. 1: Hypoxic Hypoxia
- Ex. 2: Stagnant Hypoxia
- Ex. 3: Anemic Hypoxia
- Ex. 4: Supply Dependency

Chapter 13: Lung Gas Exchange
- Ex. 1: Carbon Dioxide and Ventilation
- Ex. 2: Hemoglobin and Oxygen

Chapter 14: Shunt and Dead Space
- Ex. 1: Dead Space
- Ex. 2: VE and CO2
- Ex. 3: Shunt
- Ex. 4: VA/Q Matching

Chapter 15 Respiratory Statics
- Ex. 1: Spirometry Tracing
- Ex. 2: Predicted Normal Lung Values
- Ex. 3: Collagene and Lung Mechanics
- Ex. 4: Elastin and Lung Mechanics
- Ex. 5: Water Surface Tension and Lung Mechanics
- Ex. 6: Chest Wall Mechanics
- Ex. 7: Integrated Mechanics

Chapter 16 Respiratory Dynamics
- Ex. 1: Respiratory Muscle Function
- Ex. 2: Pressure, Flow and Volume
- Ex. 3: Airflow in the Upper Airways
- Ex. 4: Forced Expiratory Flow
- Ex. 5: The Flow Volume Loop

Chapter 17: Fluid Compartments
- Ex. 1: Fluid Volumes

Chapter 18: Kidneys and Filtration
- Ex. 1: Glomerular Filtration

Chapter 19: Acid-Base Physiology
- Ex. 1: CO2 Effects
- Ex. 2: Relationship of [H+-] and pH to SID
- Ex. 3: Gamblegrams
- Ex. 4: Strong Ion Difference

Notes:

** There are 66 exercise in total. These are active simulations that respond to user input and provide immediate feedback of physiological parameters.

** Exercises are all connected. I.E if you give drug in one exercise, you will affect all exercises unless you reset simulation.

CYBER-ANATOMY

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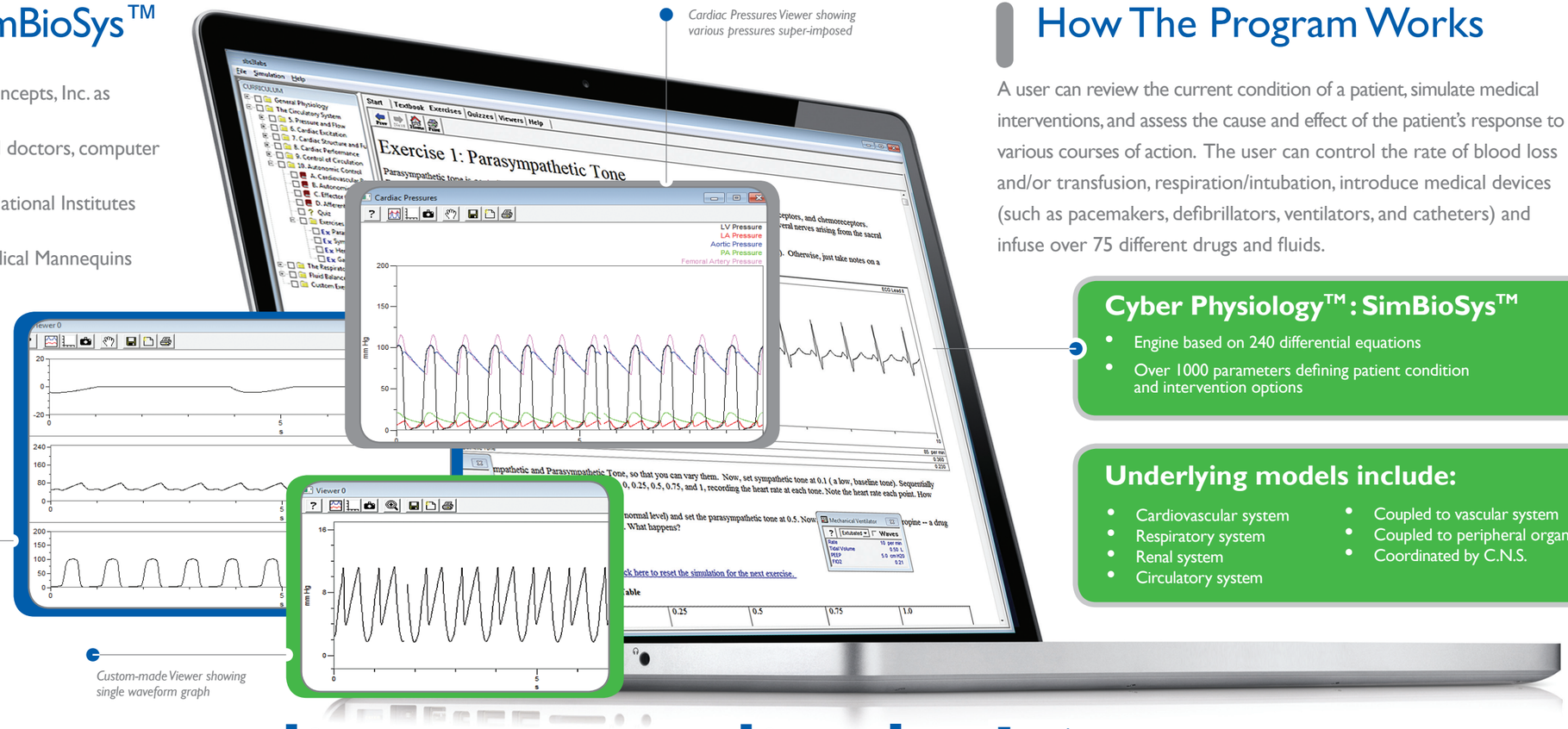
Cyber Physiology
SimBioSys™

- Nervous
- Muscular
- Circulatory
- Cardiovascular
- Respiratory
- Renal

A comprehensive software for
Simulating Human Physiology
with an interactive learning environment

Cyber Physiology™: SimBioSys™

- Developed and commercialized by Critical Concepts, Inc. as SimBioSys (1991 – 1999).
- Pioneer development team included 5 medical doctors, computer programmers, and computational physicists.
- Developed with significant funding from the National Institutes of Health over a ten year period.
- Software has been integrated into several Medical Mannequins for use in hands-on instruction and learning.
- Most sophisticated and highest fidelity simulation tool on the market, particularly for cardiovascular and respiratory system response.
- Cyber-Anatomy Corp. is advancing the state-of-the-art for the software, with a stereo 3D version planned for release in late 2012.



Cardiac Pressures Viewer showing various pressures super-imposed

Custom-made Viewer showing mulitple viewers.

Custom-made Viewer showing single waveform graph

How The Program Works

A user can review the current condition of a patient, simulate medical interventions, and assess the cause and effect of the patient's response to various courses of action. The user can control the rate of blood loss and/or transfusion, respiration/intubation, introduce medical devices (such as pacemakers, defibrillators, ventilators, and catheters) and infuse over 75 different drugs and fluids.

Cyber Physiology™: SimBioSys™

- Engine based on 240 differential equations
- Over 1000 parameters defining patient condition and intervention options

Underlying models include:

- Cardiovascular system
- Respiratory system
- Renal system
- Circulatory system
- Coupled to vascular system
- Coupled to peripheral organs
- Coordinated by C.N.S.

Students can direct medical interventions and analyze patient response in a comprehensive, real-time, virtual environment.

Real-Time and Coordinated Simulations

The real-time simulation feature provides multi-dimensional feedback, allowing the student to analyze the outcome of medical interventions in real-time, as they occur. Output parameters are calculated several times per millisecond and displayed through commonly used graphs and readouts. All simulations are synchronized, offering a comprehensive and accurate view of patient response.

Using Cyber Physiology™: SimBioSys™

In its current state, the software can be used as a supplement for any physiology course. The program was developed specifically for first and second-year medical students, but the basic concepts are applicable to undergraduate and post-doctoral study as well.

Exercises: In addition to more than 65 pre-configured exercises, the user has full control over the virtual patient to define an unlimited series of custom exercises. The custom exercises can be distributed by an instructor to students using the SimBioSys software.

Quizzes: The software offers 19 separate quizzes.

Viewers: Patient parameters can be viewed in real-time using numeric panels, waveforms, trend plots, curves, loops, and scatterplots. All readouts are coordinated to show patient status and update in real-time throughout an exercise.

Tools: A full array of tools are provided, including a drug and fluid infusor with over 75 drugs and fluids, blood withdrawal, catheters and tubes, defibrillator, mechanical ventilator, and pacemaker.

Tutorials & Help: The software includes a full help system with an introduction to physiology labs, description of viewers/readouts, a description of all tools, a guide to the generation of custom exercises, and more.