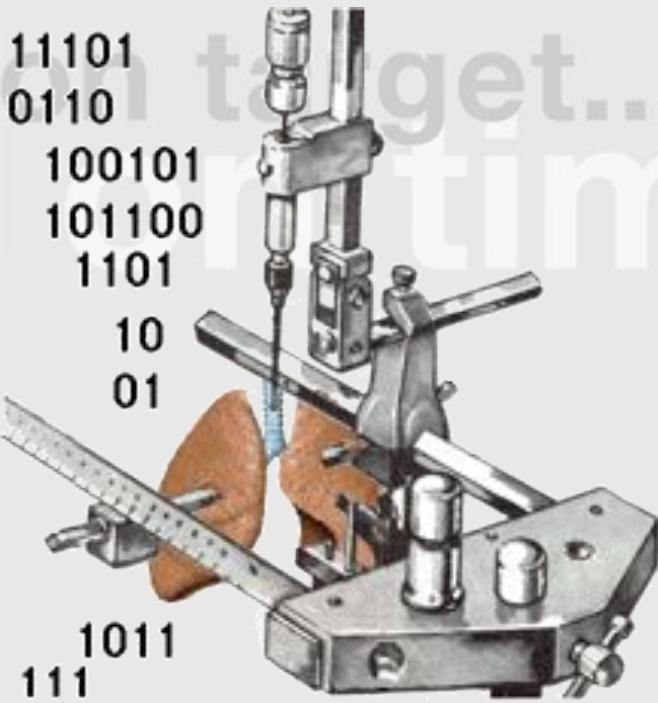




IntelliSoft

# Imitation of Biological Processes

Medical Simulations and Analysis



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# Imitator - Introduction

- Human body simulation software, developed in the Vinnitsa State Medical University (Ukraine)
  - Modeling of all the internal biological processes
  - From internal parts (organs) down to a cell level
  - Customizable biochemical model of each organ
  - Interrelation between organs
  - Influence of the environment and other initial conditions



# The concept of simulation

- Step-by-step simulation of each organ.
- Mathematical model of organs are based on biochemical and fermentative equations.
- Initial conditions and parameters of organs allow simulating of a given case (disease).
- Average values of parameters are provided in the application database.
- Parameters are updated either by a user, or by the simulation engine.
- A change of any parameter (direct or indirect) cause the "chain updates" of other parameters.



# Scope (internal processes)

- Interlocking model of main organs, providing a simulations of core processes:
  - metabolism (e.g. biochemical transformations of food, hormones; synthesis of all proteins)
  - blood circulation
  - breathing
- Drug influence on each organ





# Scope (external factors)

- Environment
  - temperature, partial pressure, oxygen pressure, carbon dioxide pressure, nitrogen pressure, air humidity, sun UV, regions time zones
- Nourishment
  - food products and ingredients (proteins, fats, carbohydrates, electrolytes, aminoacids, fatty acids, cellulose, collagen, casein etc.), diets, sugar substitutes used in diabetes etc
- Energy expenditures
  - manual labor



# Implementation

- Advanced graphics user interface (GUI) based on visual models.
- Customizable mathematical models.
- Database-driven system.

The screenshot displays the Imitator software interface, which includes several windows for physiological simulation:

- Alveola [mixing of gases and "a trap of air"]**: Shows ventilation data for dead and active spaces. 

| Gas          | Dead Space (ml/min) | Active Space (ml/min) |
|--------------|---------------------|-----------------------|
| Oxygen       | 183                 | 461                   |
| Carbonic gas | 44                  | 30                    |
| Nitrogen     | 885                 | 1881                  |
| Argon        | 10                  | 21                    |
- Primary/Secondary wetting**: Shows a cross-section of a kidney with labels for Glomulus, pH, and vit.D.
- Pass entocytosis**: Shows a detailed view of a capillary with parameters like Speed of blood (0.487) and Length of a capillary (0.010).
- Control Panel**: Includes buttons for Potential, General, EKG-norm, Viewing, diagram, erase, Choice, and Exit, along with sliders for diagram size, recording speed, and delay.



# How it works

- Lunch the software
- Create (or load) a profile
  - set up the environment (temperature, weather etc)
  - edit individual properties (weight, sex, age etc)
  - define a pathology or disease (optional)
  - select food or drugs (optional)
- Run simulation
  - 24 hour simulation takes few seconds
- Observe the result  
(new values of parameters)



# Applications

- Modeling biological processes
- Modeling human diseases
- Modeling the effect of drugs and the environment on an organism
- Modeling medical equipments (e.g. anaesthesia machine is included)
  - built-in medical hardware and software
- Industries:
  - Education
  - Health care
  - Research and Development





# Availability

- Working system is available for
  - Windows platform
  - Web-based access
- English and Russian versions
- Commercial product can be developed in a matter of a month to meet the specific customer requirements



# More Information

- Imitator web site
  - <http://www.simanest.org/medsim/>
- Contacts
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