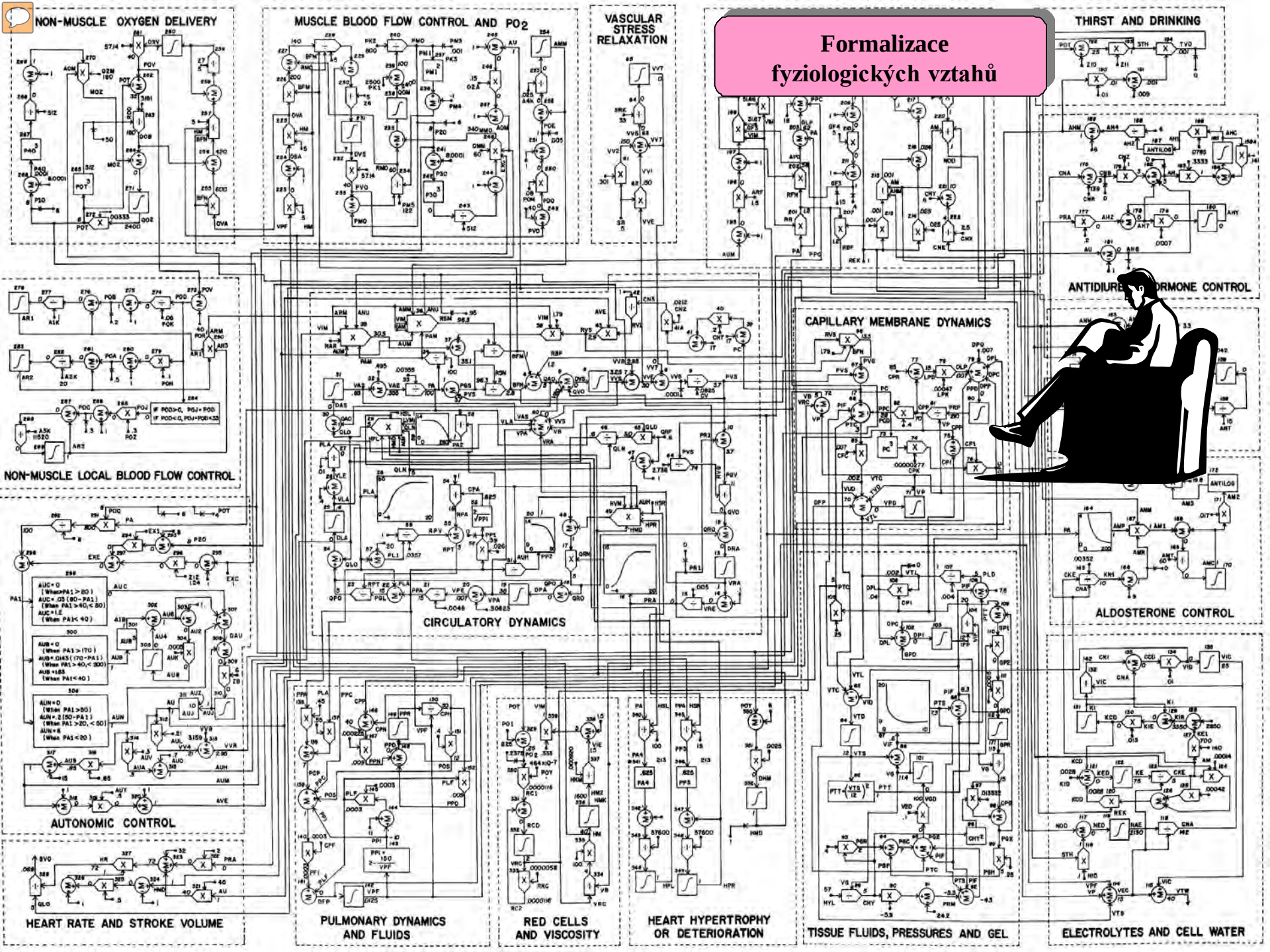
Modelica Day 2015

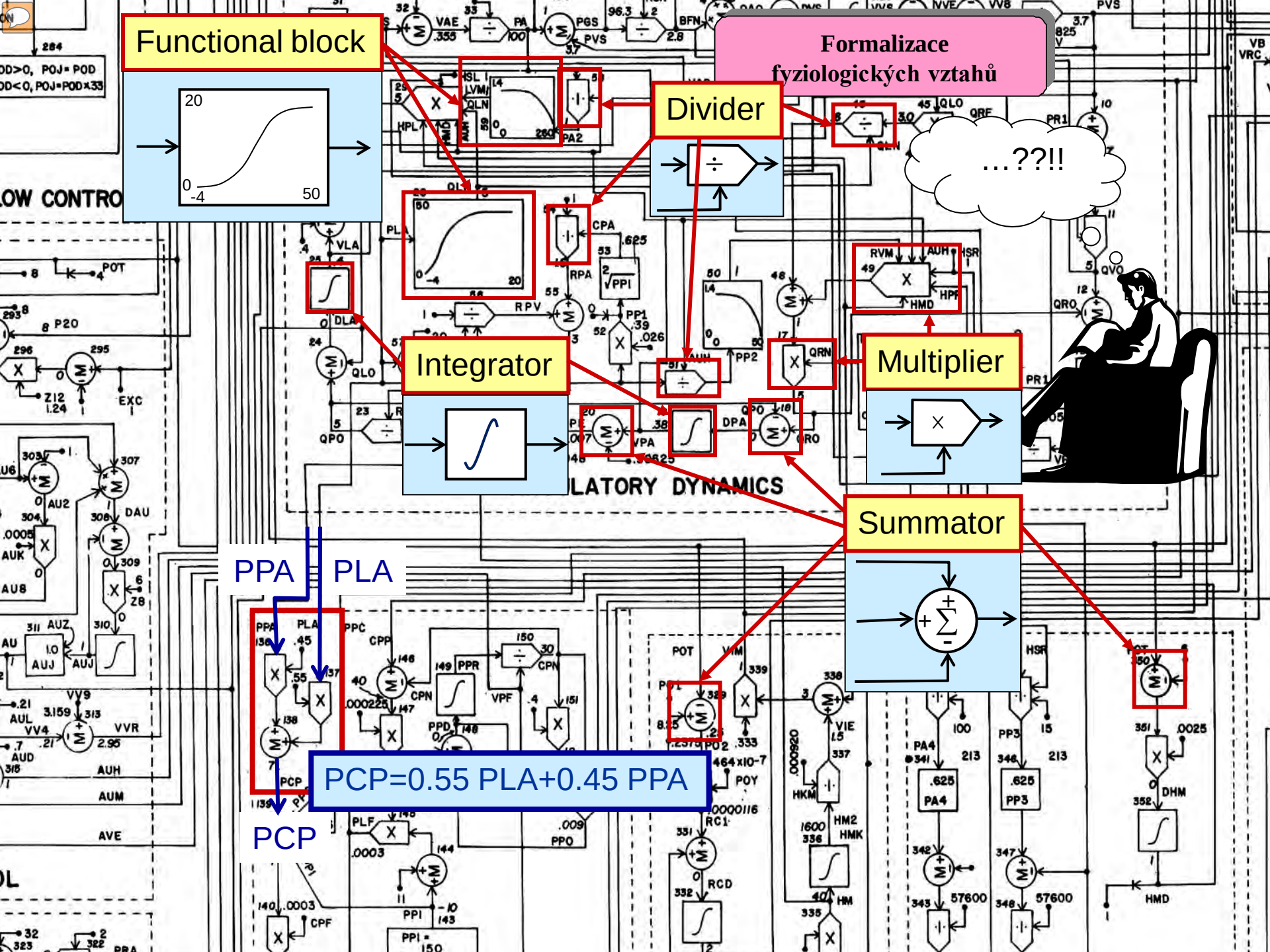
Jiří Kofránek

Naše cesta k Modelice

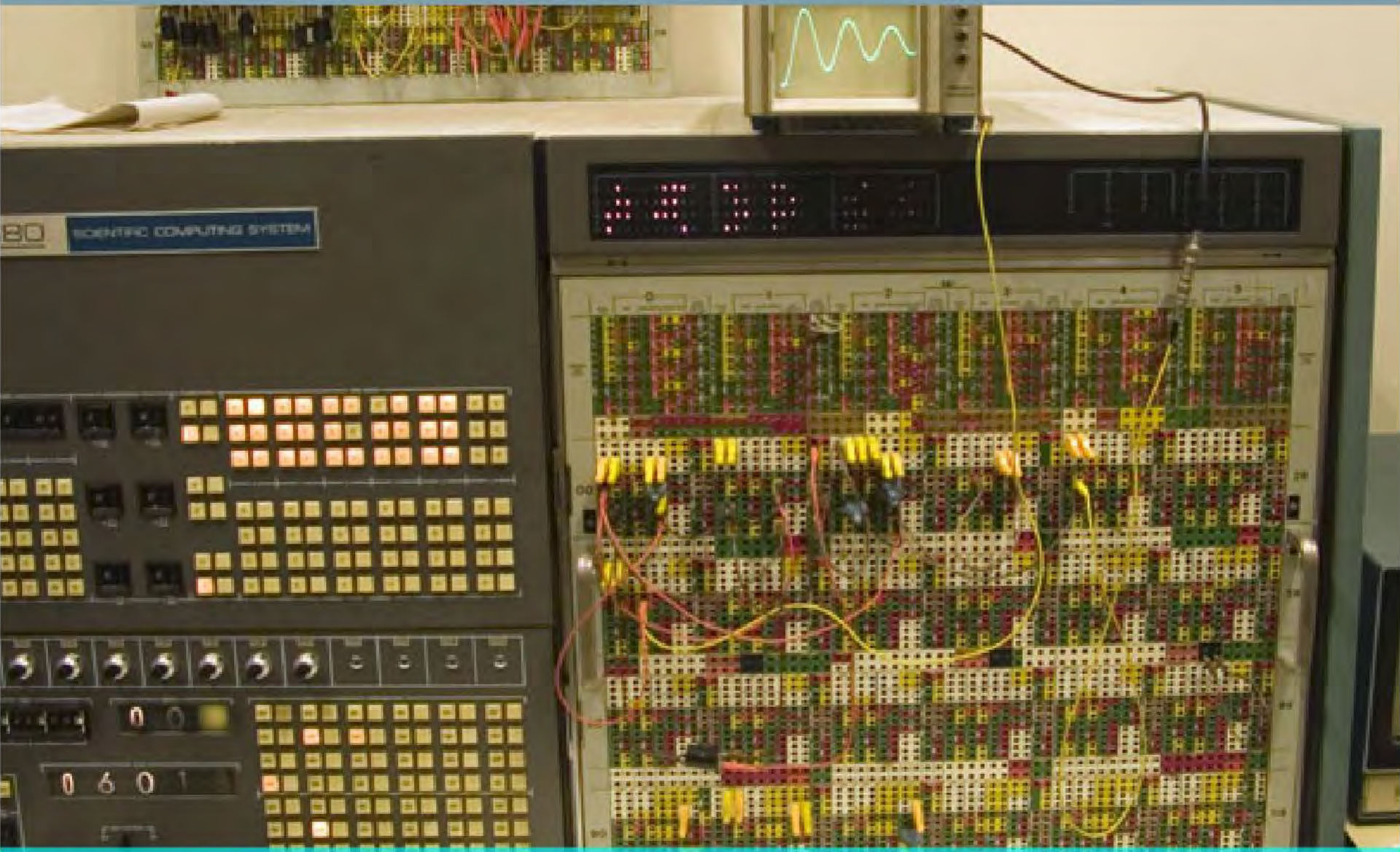
Jiří Kofránek

Formalizace fyziologických vztahů



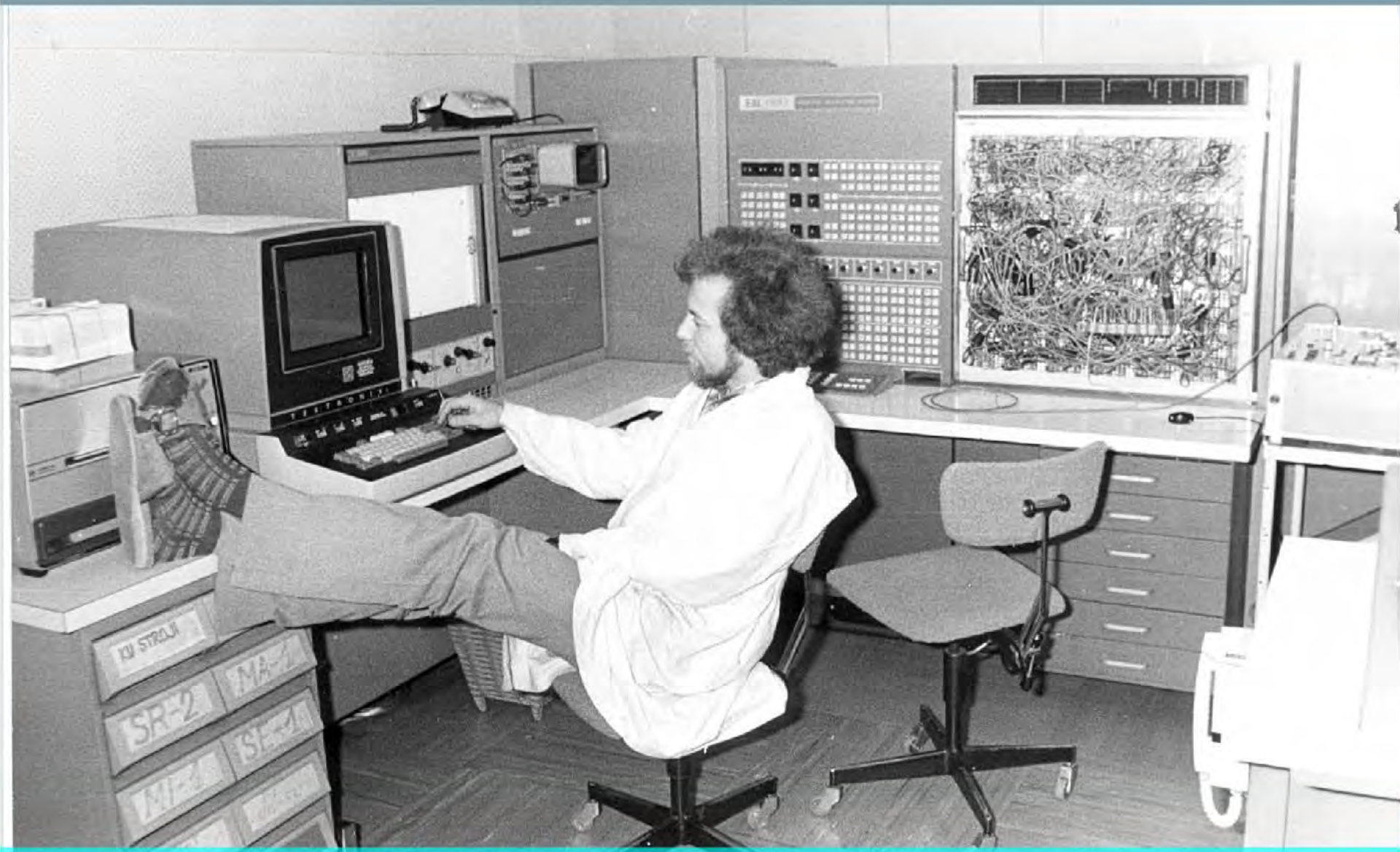

Functional block
20
0
-4
50
Formalizace fyziologických vztahů
Divider
...??!!
Integrator
Multiplier
Summator
PPA
PLA
PCP=0.55 PLA+0.45 PPA
PCP

Nástoje pro modelování - specializovaná softwarová prostředí



Analogové a hybridní počítače: fyzické propojování výpočetních prvků kablíky

Nástoje pro modelování - specializovaná softwarová prostředí

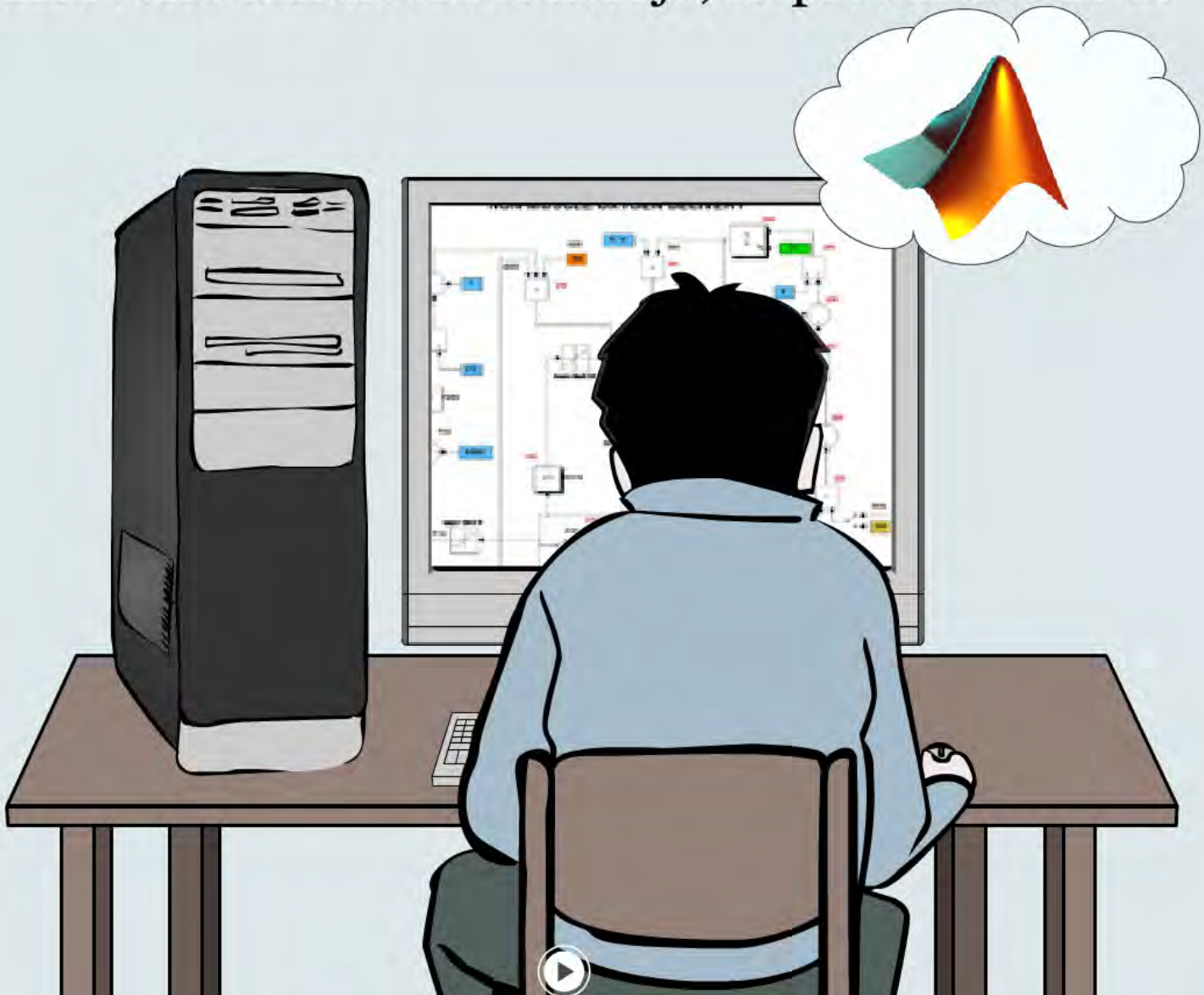


Analogové a hybridní počítače: fyzické propojování výpočetních prvků kablíky

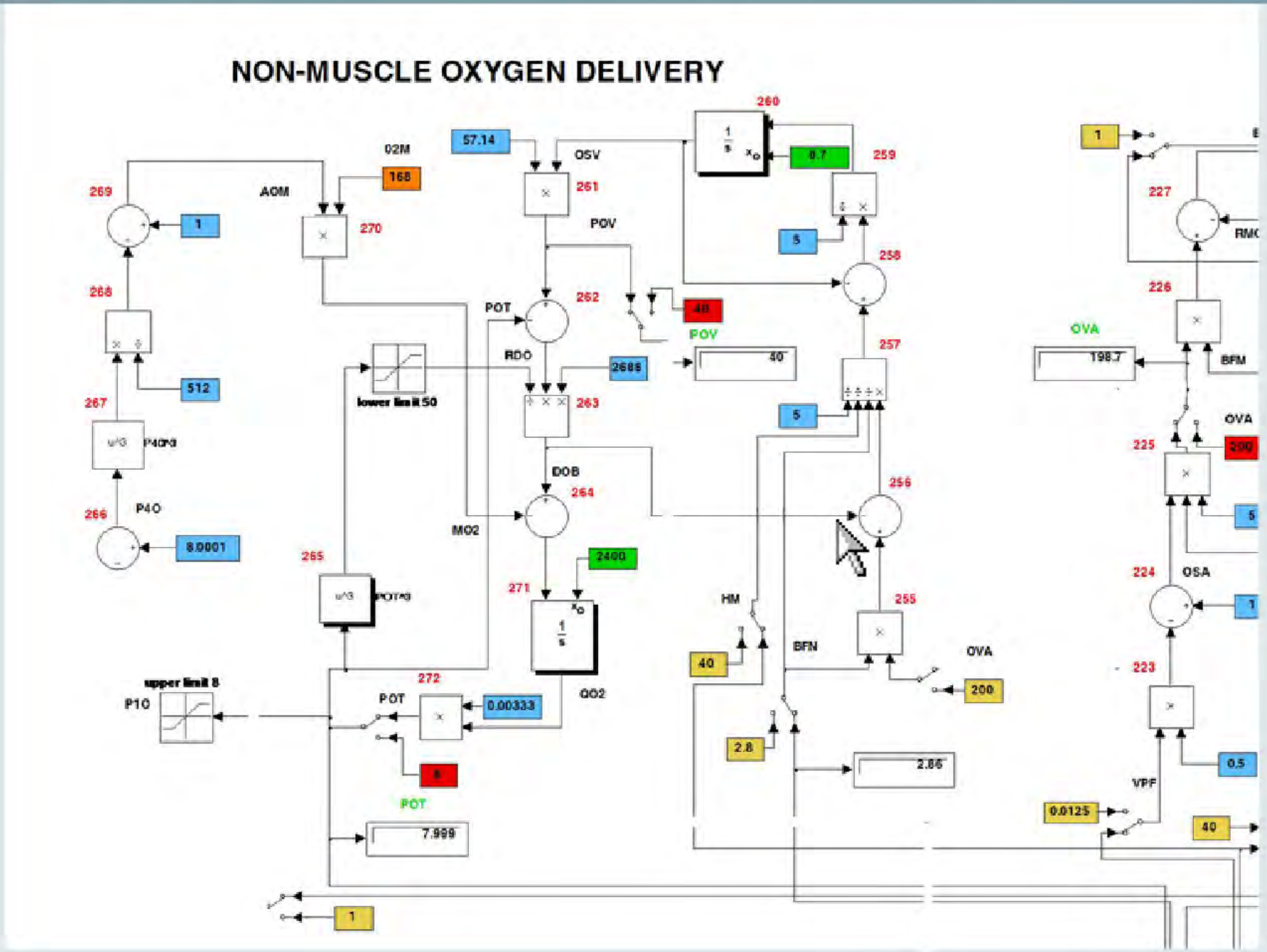
Číslicové počítače: modely ve standardních programovacích jazycích (FORTRAN, PASCAL, C++ ...)

Analogové a hybridní počítače: fyzické propojování výpočetních prvků kablíky

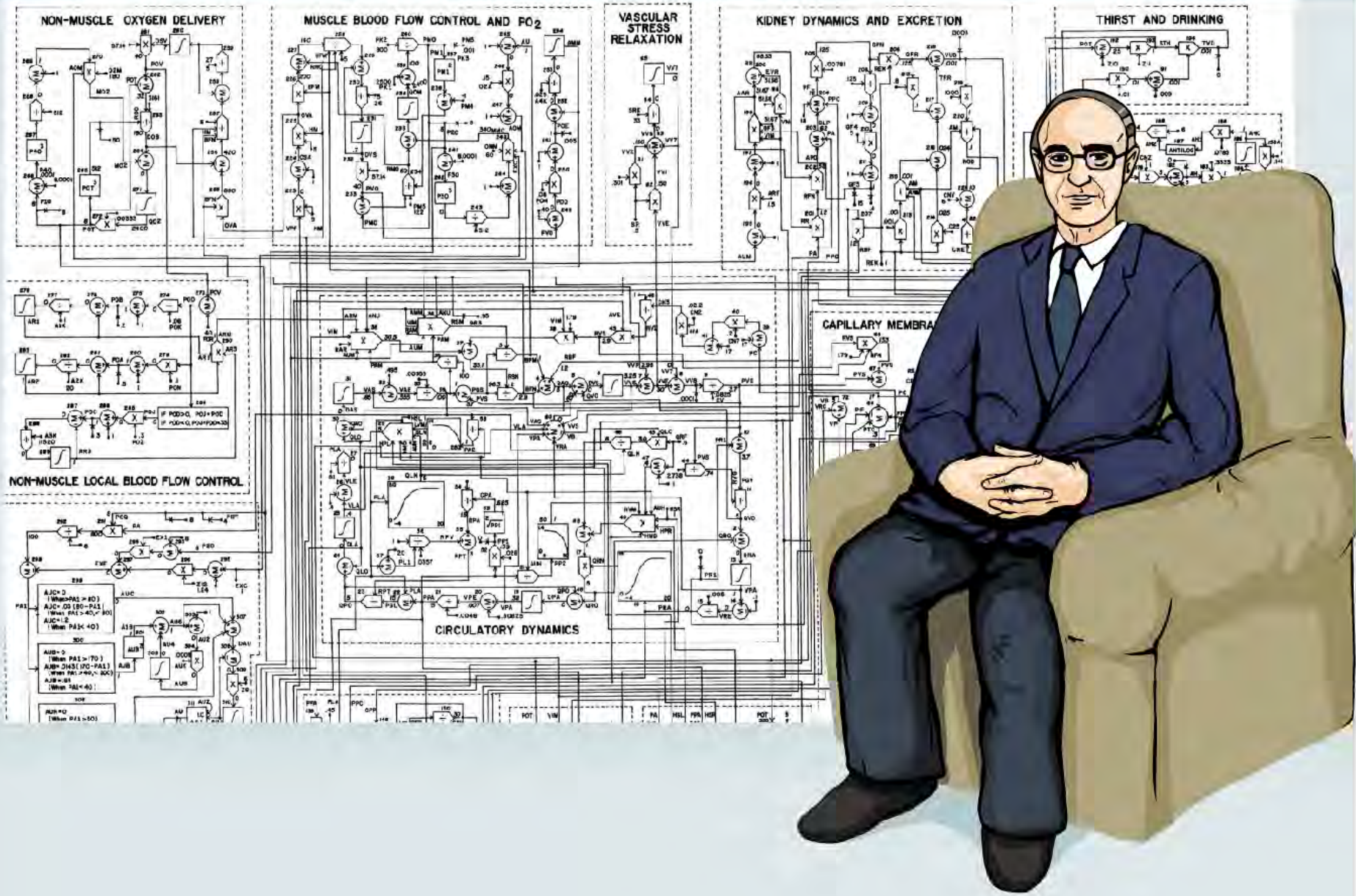
Specializované simulační nástroje, např. SIMULINK



Nástoje pro modelování - specializovaná softwarová prostředí



Guytonův diagram v Simulinku



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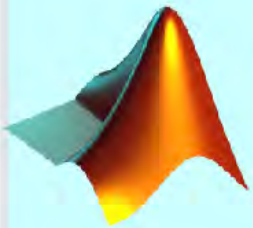
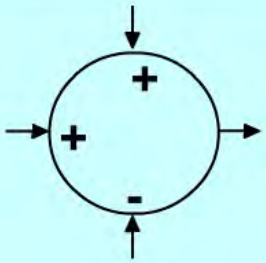
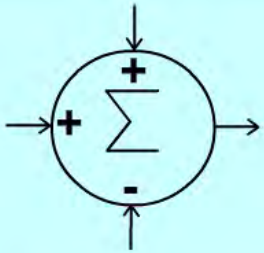
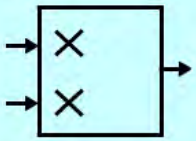


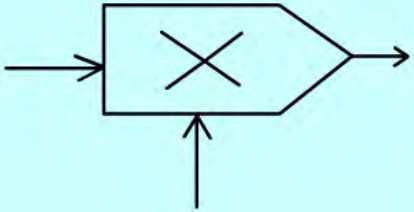


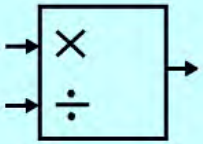
Sumátor



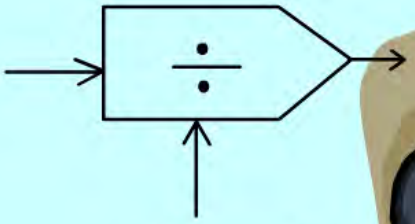


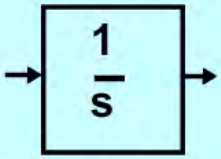
Násobička



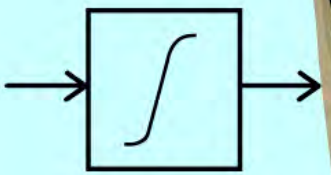


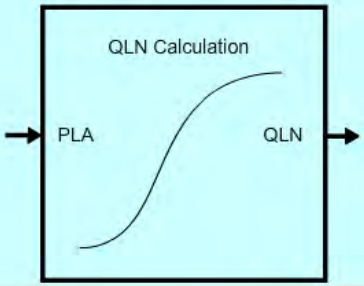
Dělička



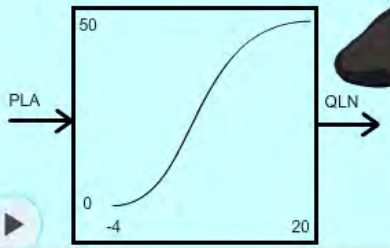


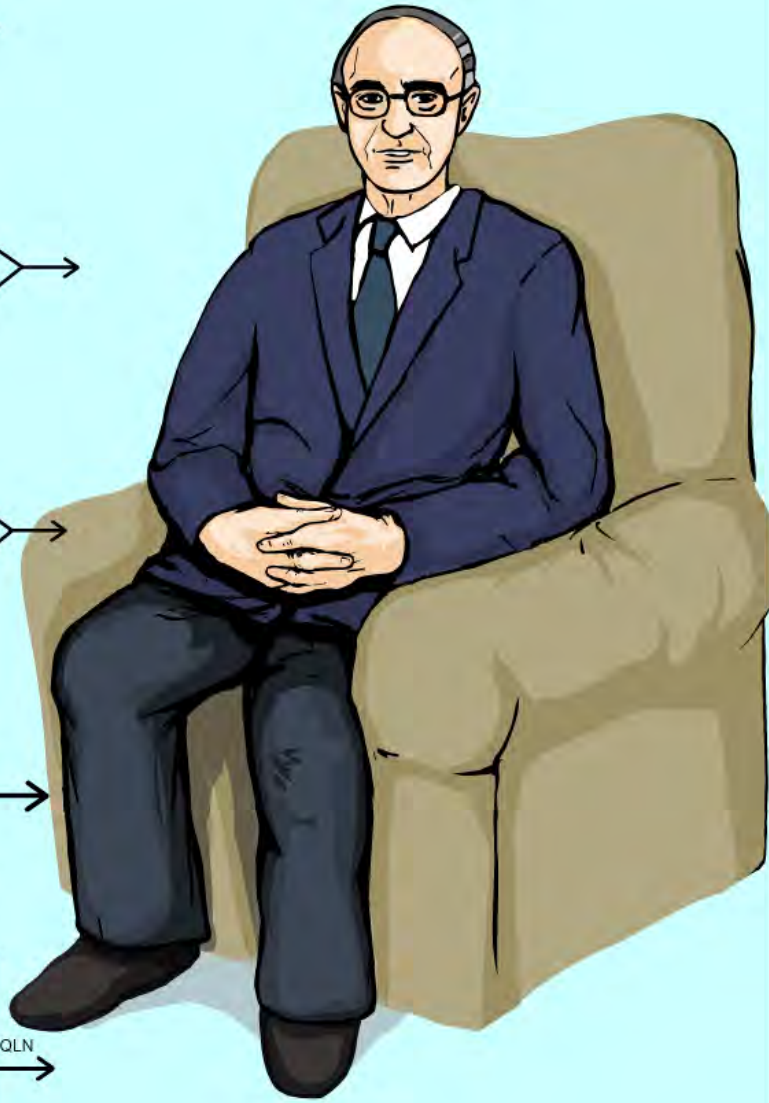
Integrátor



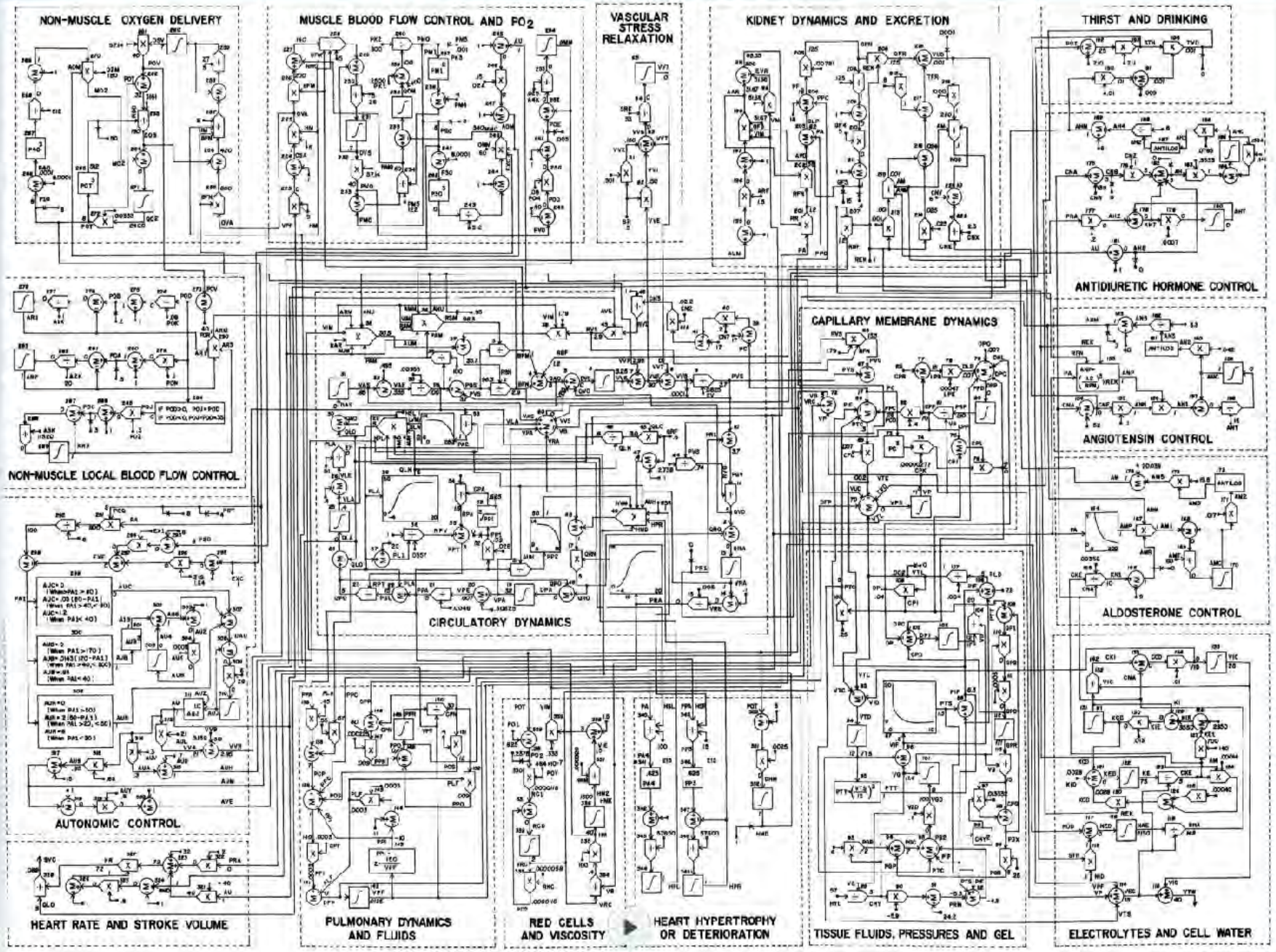


Funkční blok

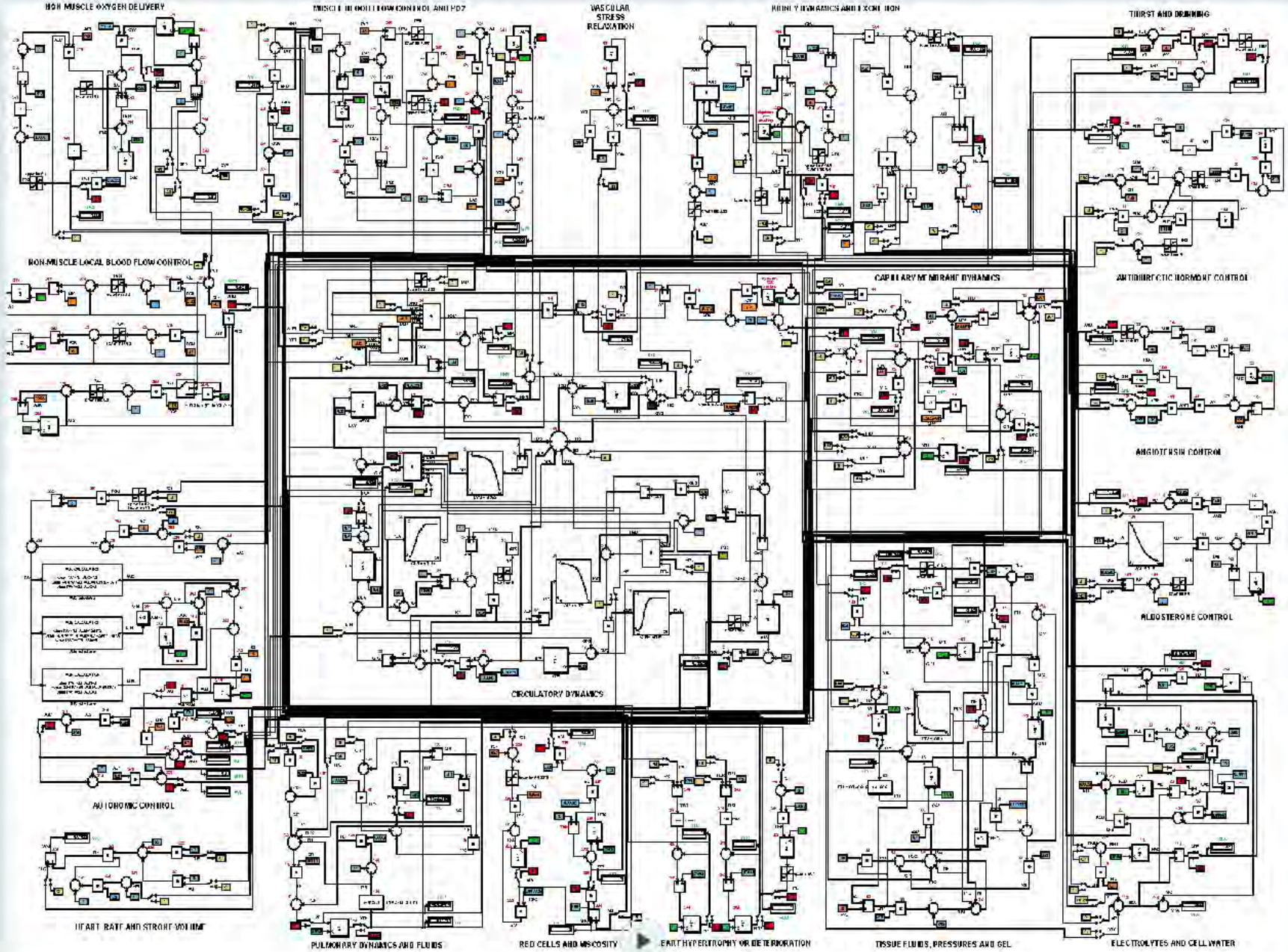




Guytonův diagram v Simulinku



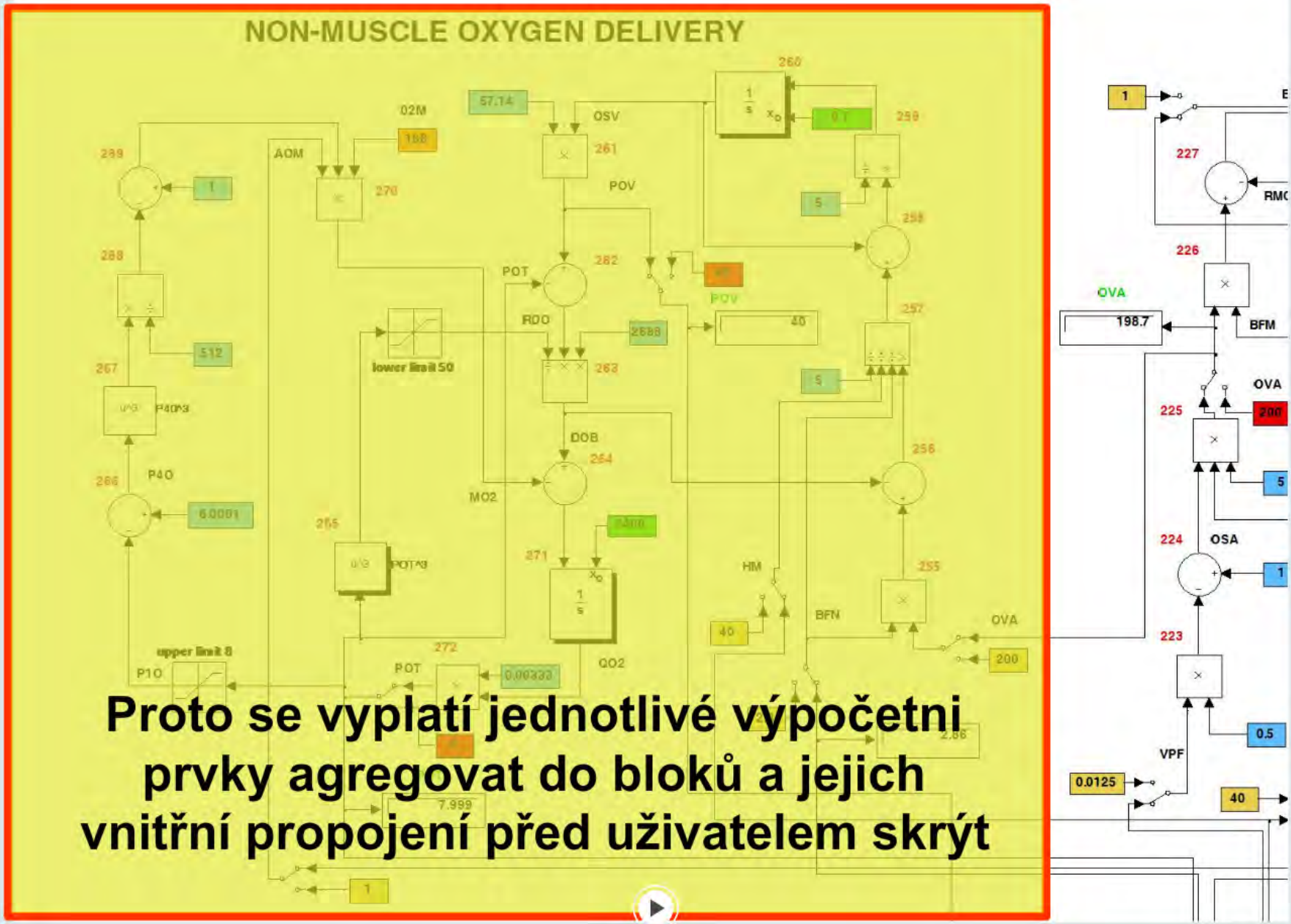
Guytonův diagram v Simulinku

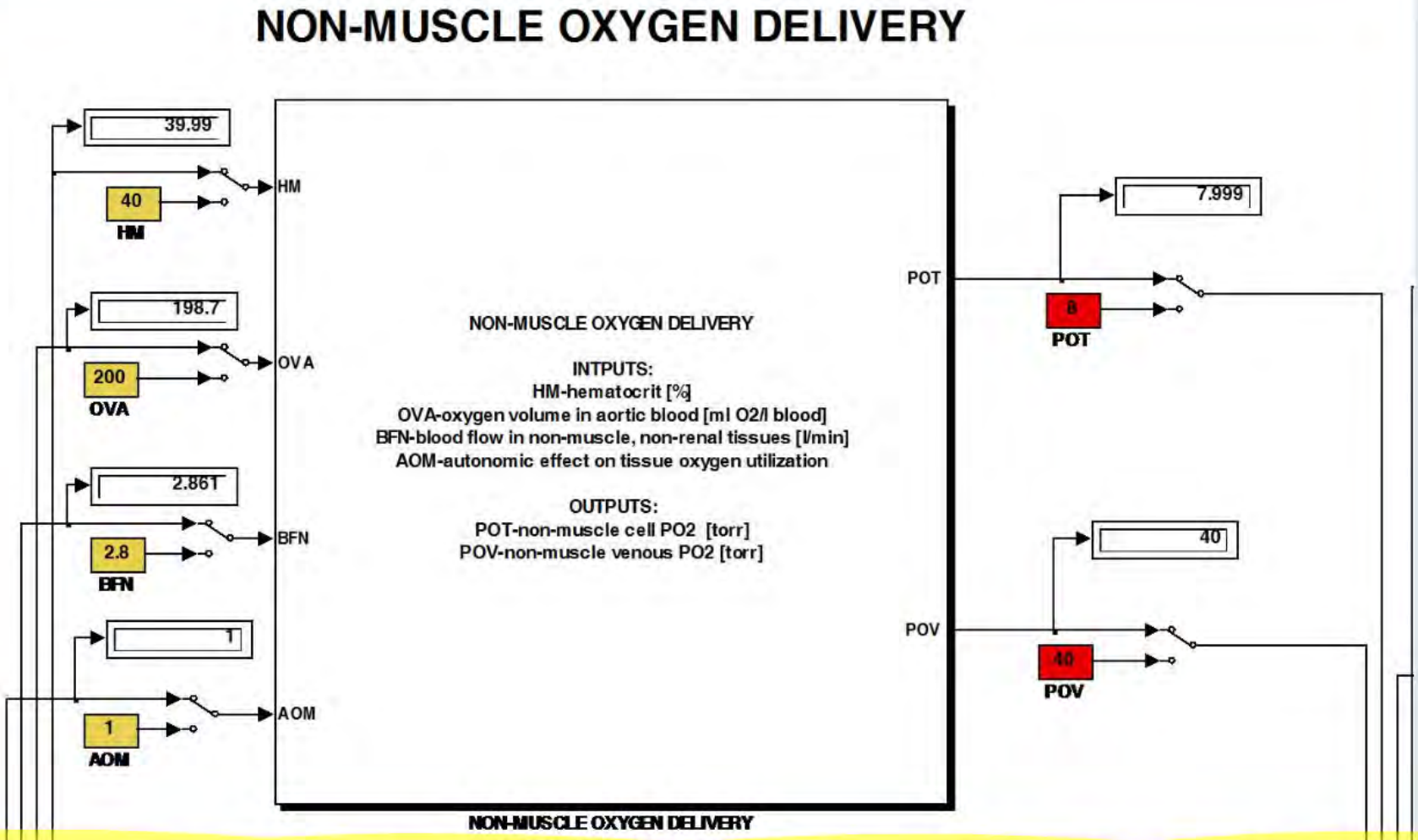


Simulinková knihovna Physiolibrary

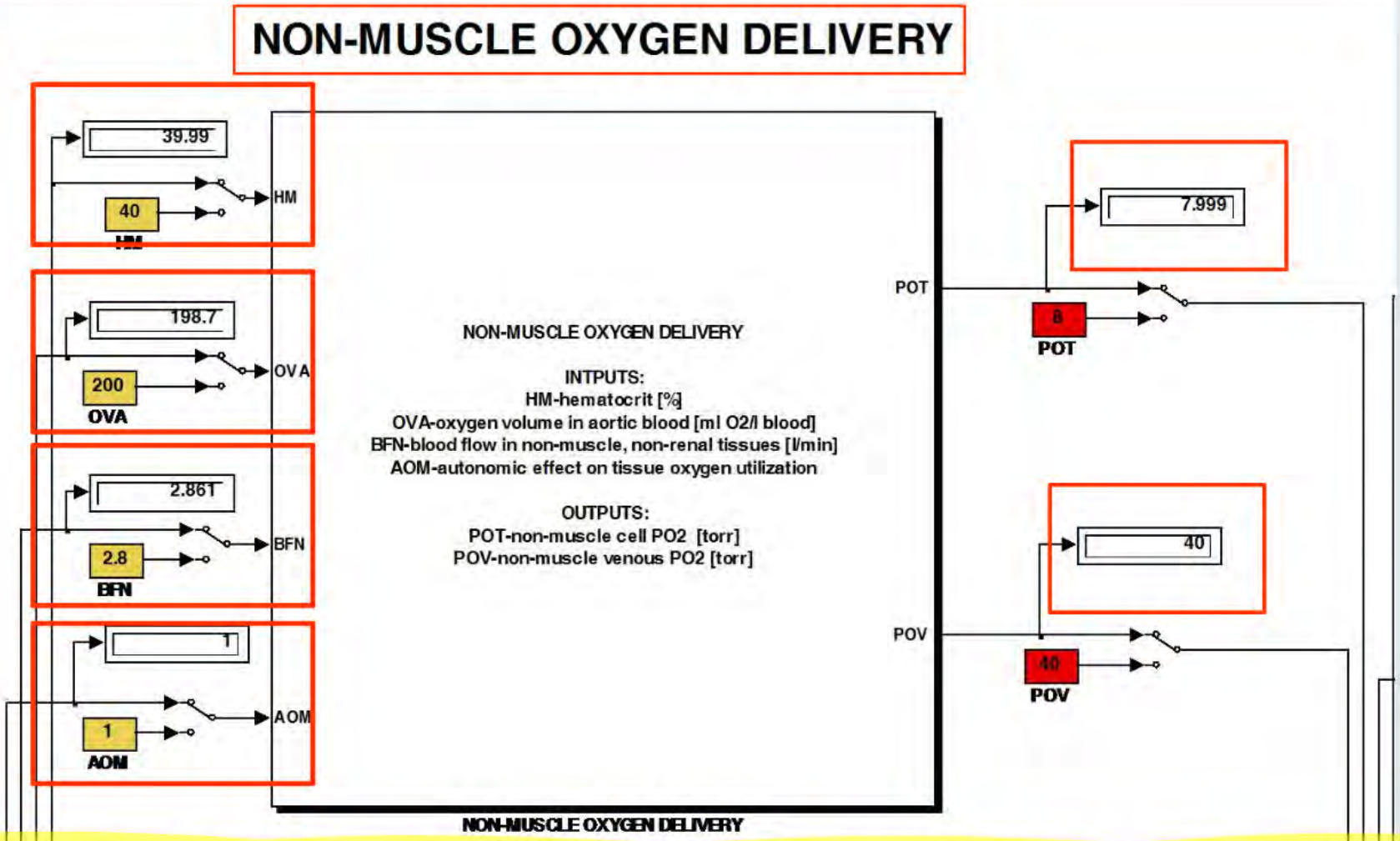
Složitě provázané simulinkové výpočetní sítě jsou, zejména pro experimentální fyziology, málo srozumitelné

Simulinková knihovna Physiolibrary

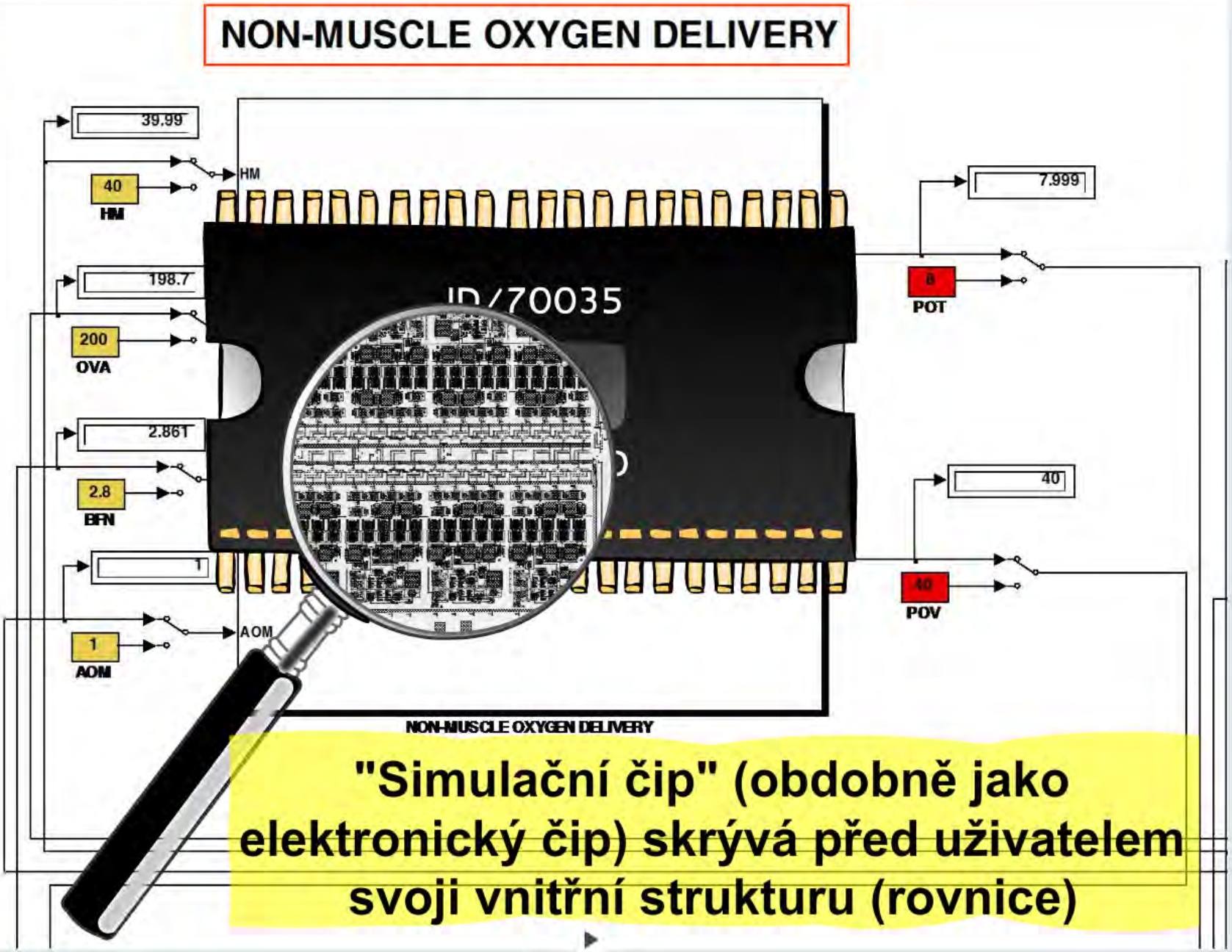




Agregovaný simulační blok s definovanými vstupy a výstupy je pro fyziology mnohem srozumitelnější

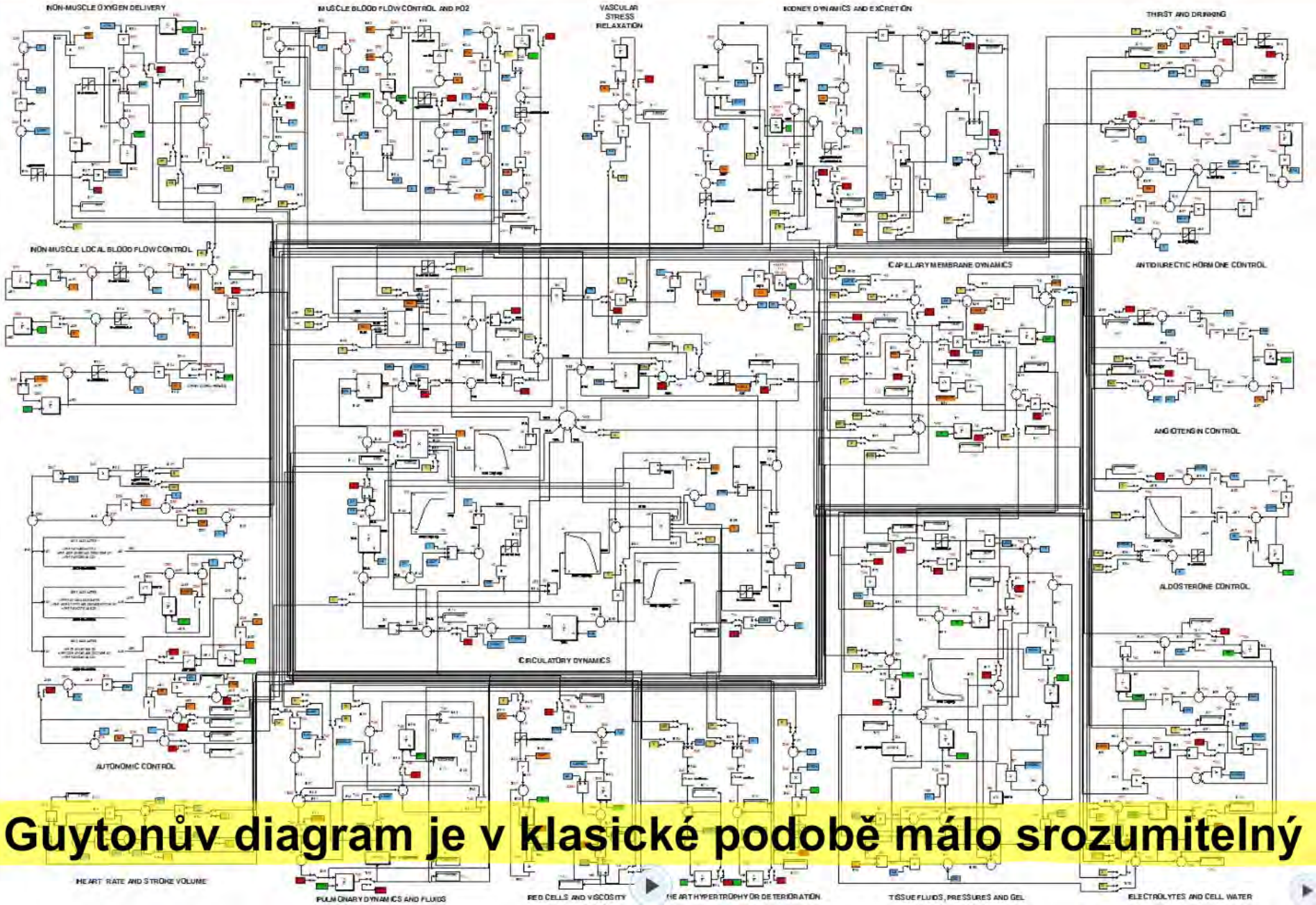


V simulačním nástroji "Simulink" můžeme testovat chování agregovaného simulačního bloku



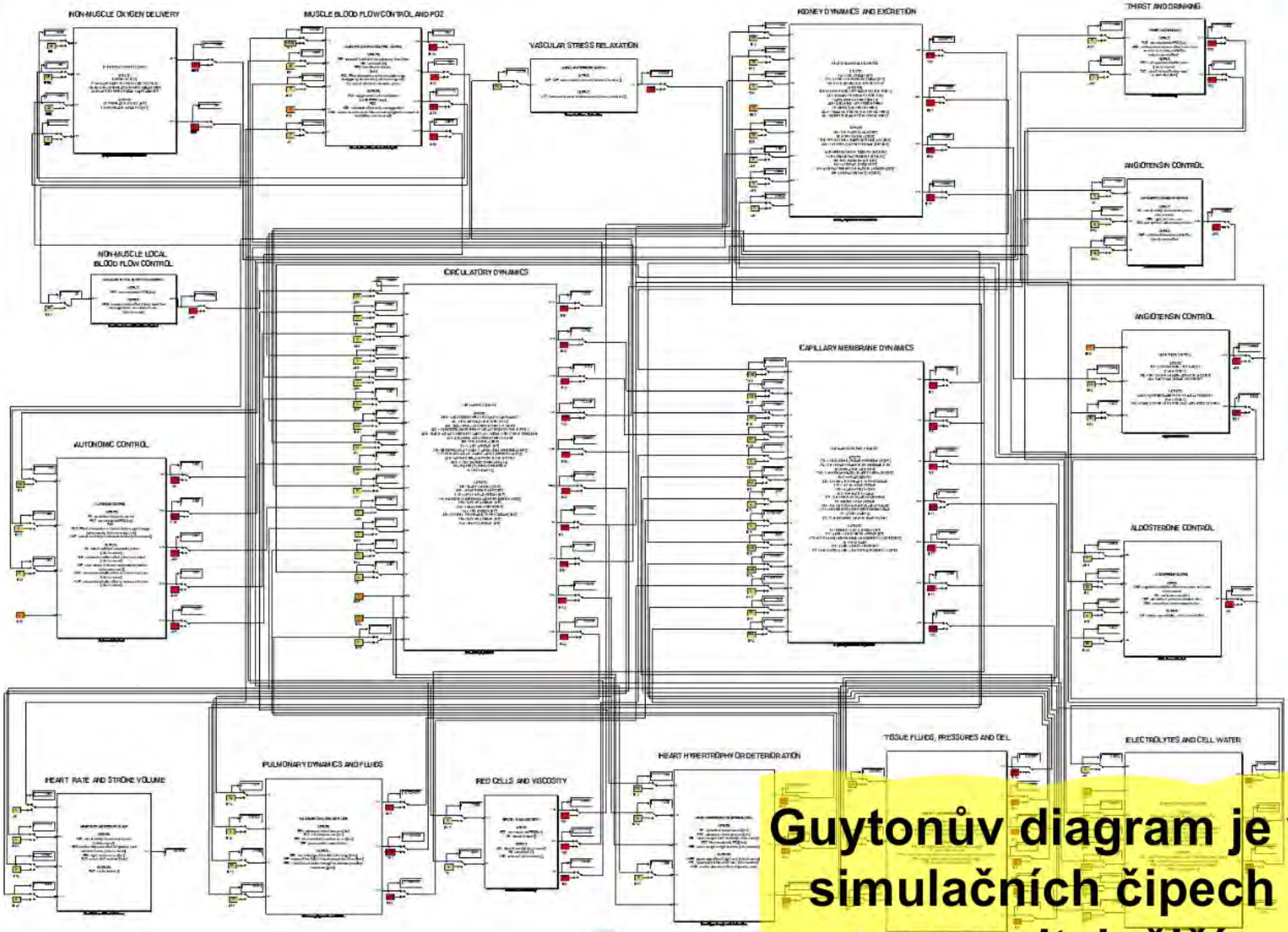
"Simulační čip" (obdobně jako elektronický čip) skrývá před uživatelem svoji vnitřní strukturu (rovnice)

Simulinková knihovna Physiolibrary



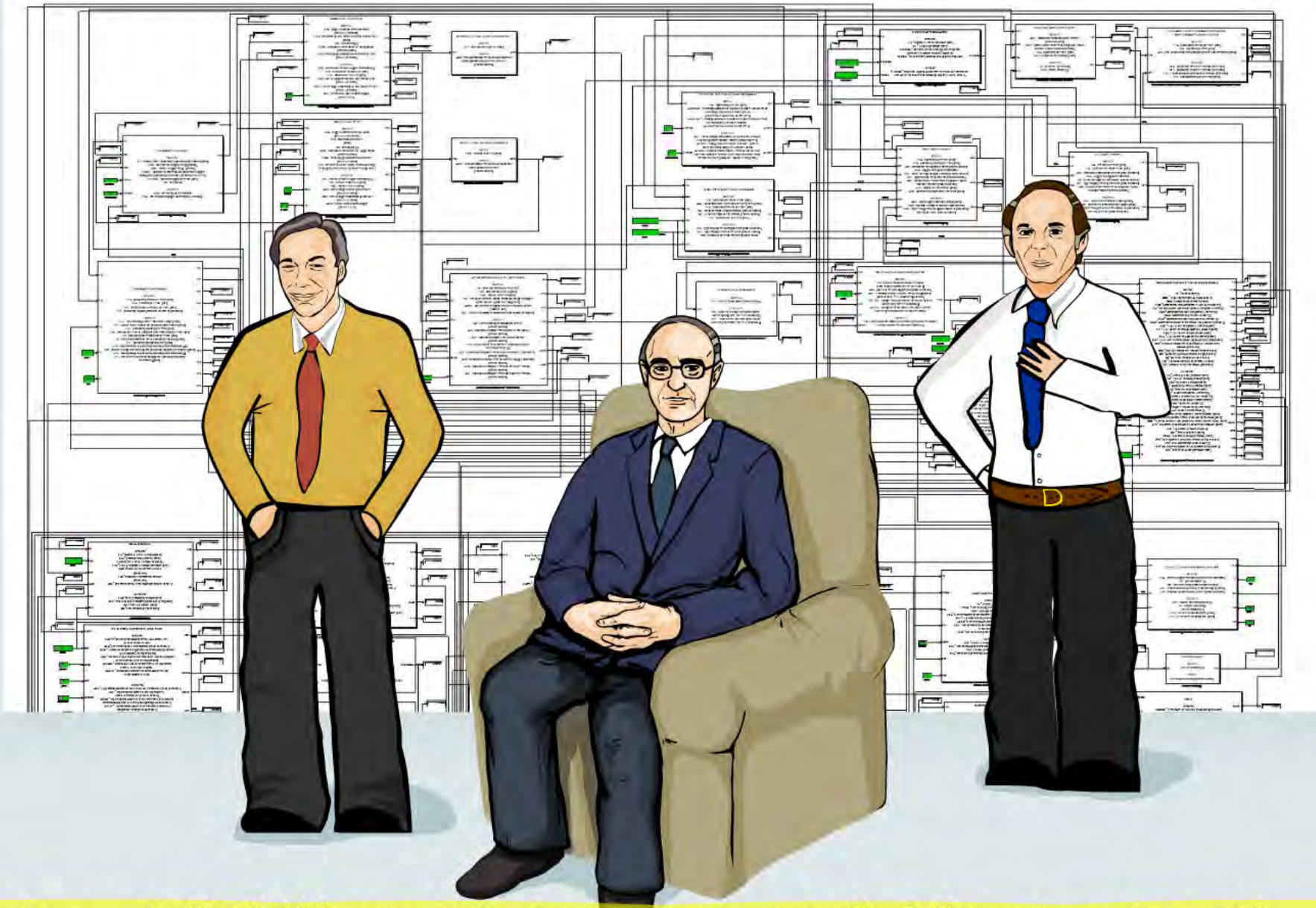
Guytonův diagram je v klasické podobě málo srozumitelný

Simulinková knihovna Physiolibrary



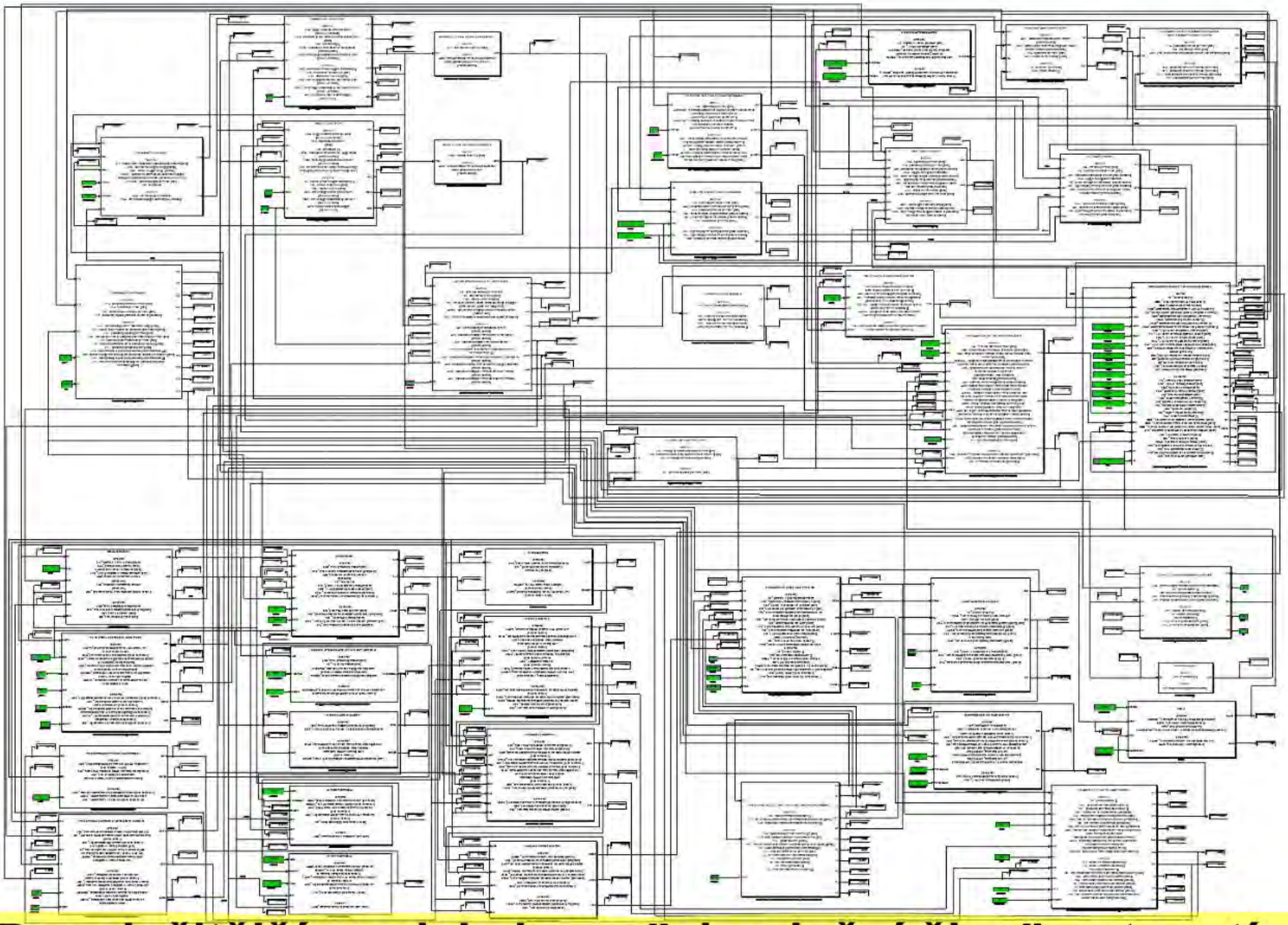
Guytonův diagram je v simulačních čipech srozumitelnější

Simulinková knihovna Physiolibrary



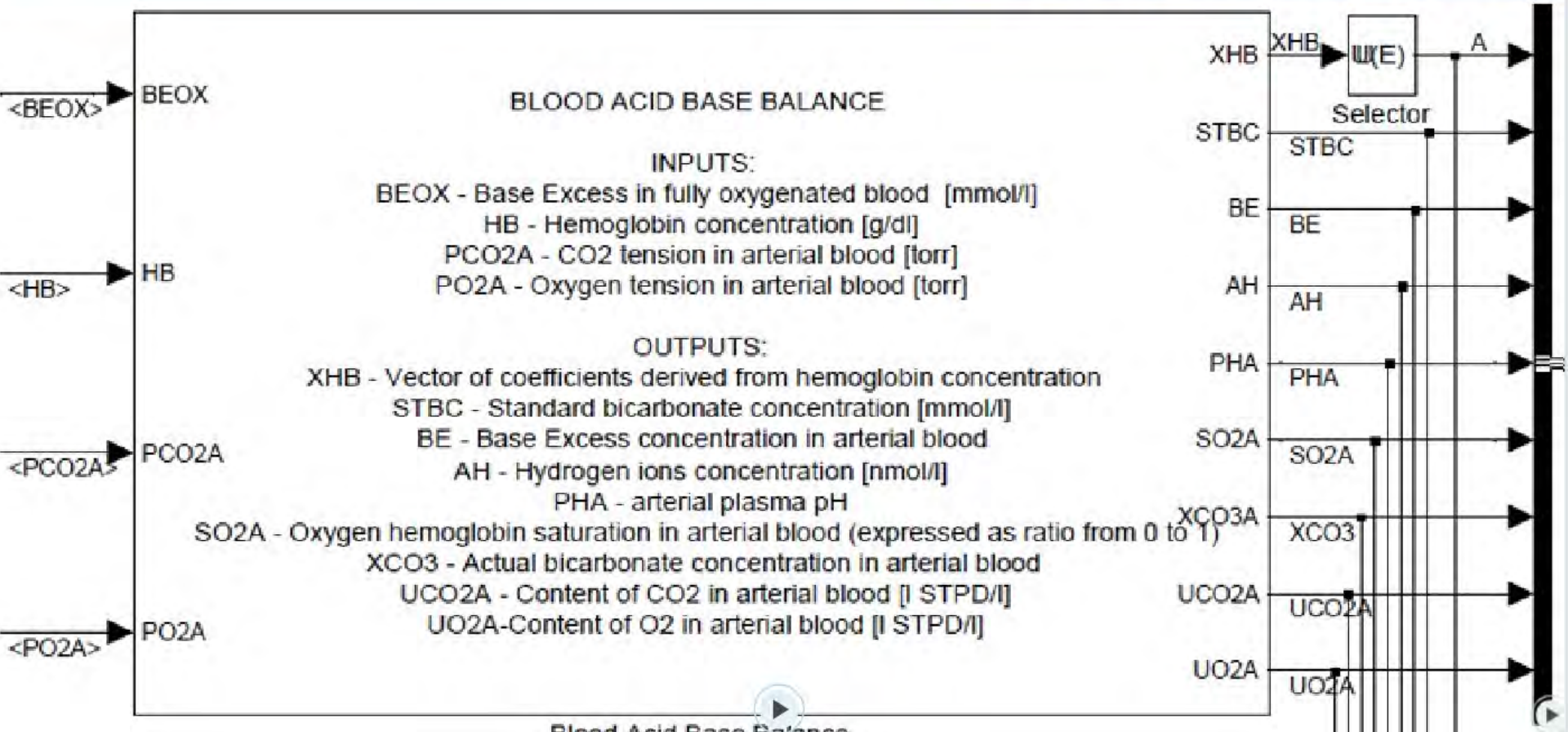
Pro složitější modely jsou "simulační čipy" nutností

Simulinková knihovna Physiolibrary



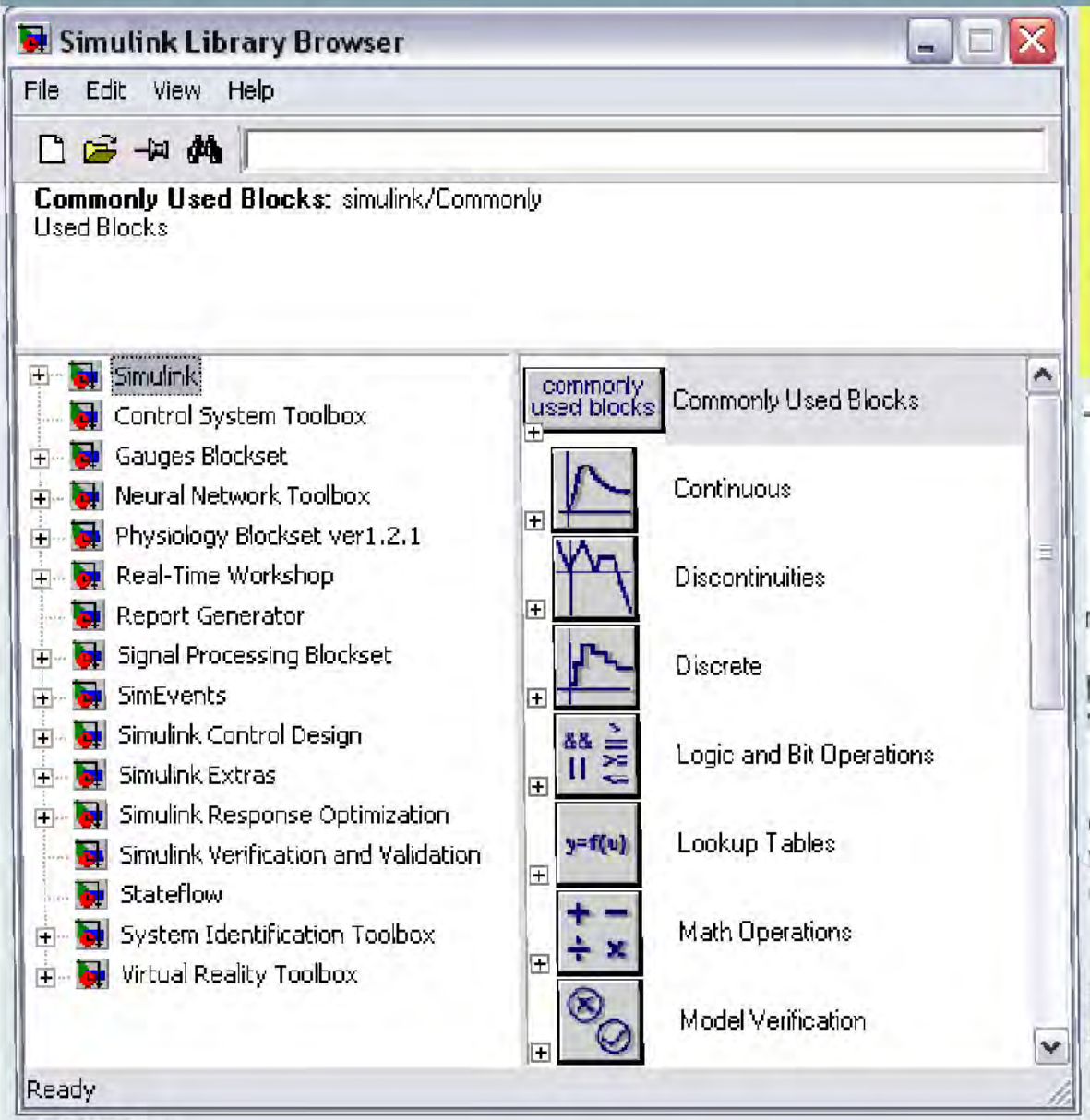
Pro složitější modely jsou "simulační čipy" nutností

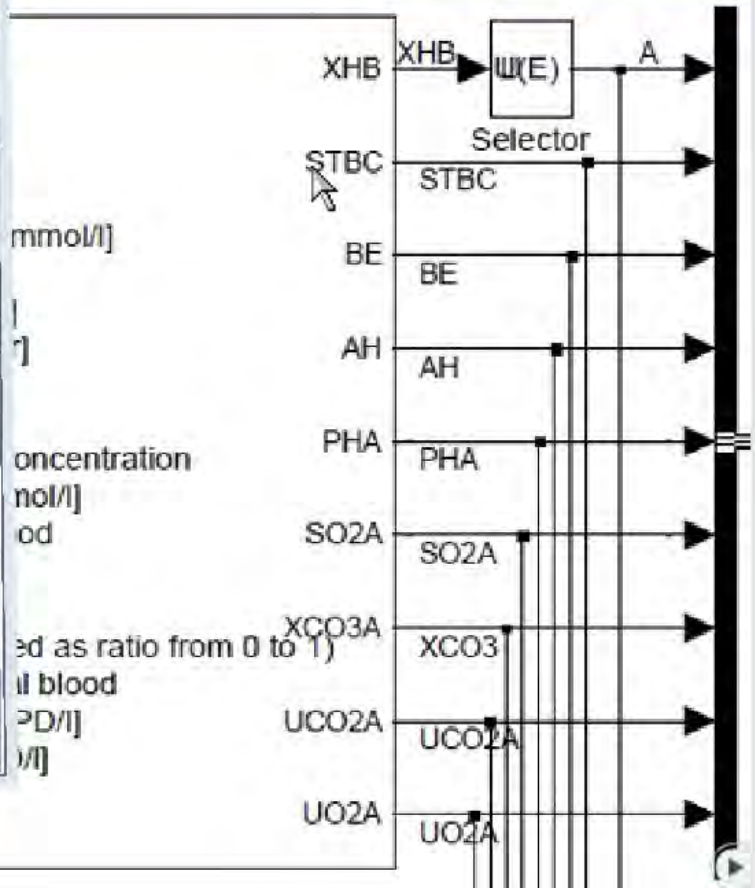
Jednou už vytvořené "Simulačních čipy" jsou znovupoužitelné! Dají se využívat v různých modelech



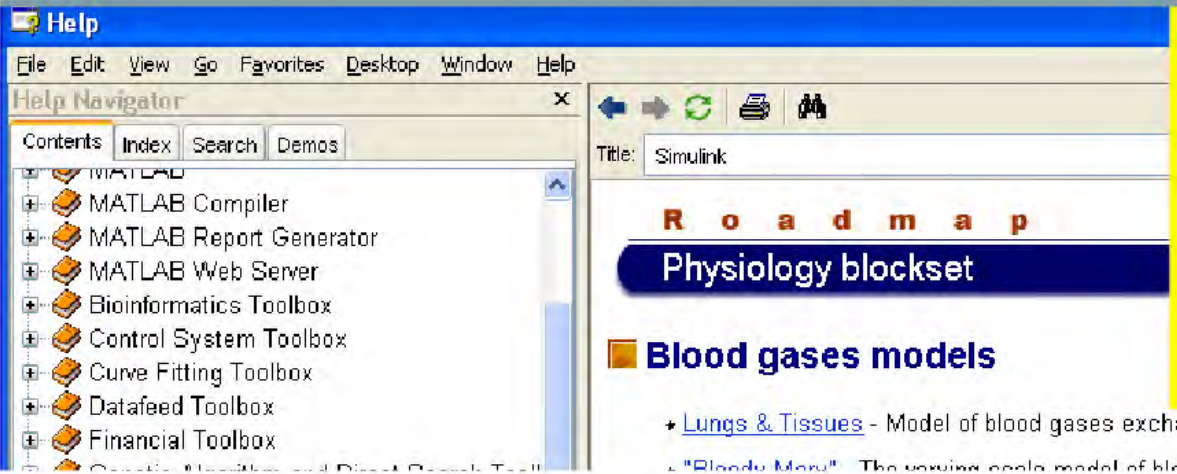
Simulinková knihovna Physiolibrary

Ve veřejně přístupné knihovně PHYSIOLIBRARY je nabídka "simulačních čipů" ke stažení

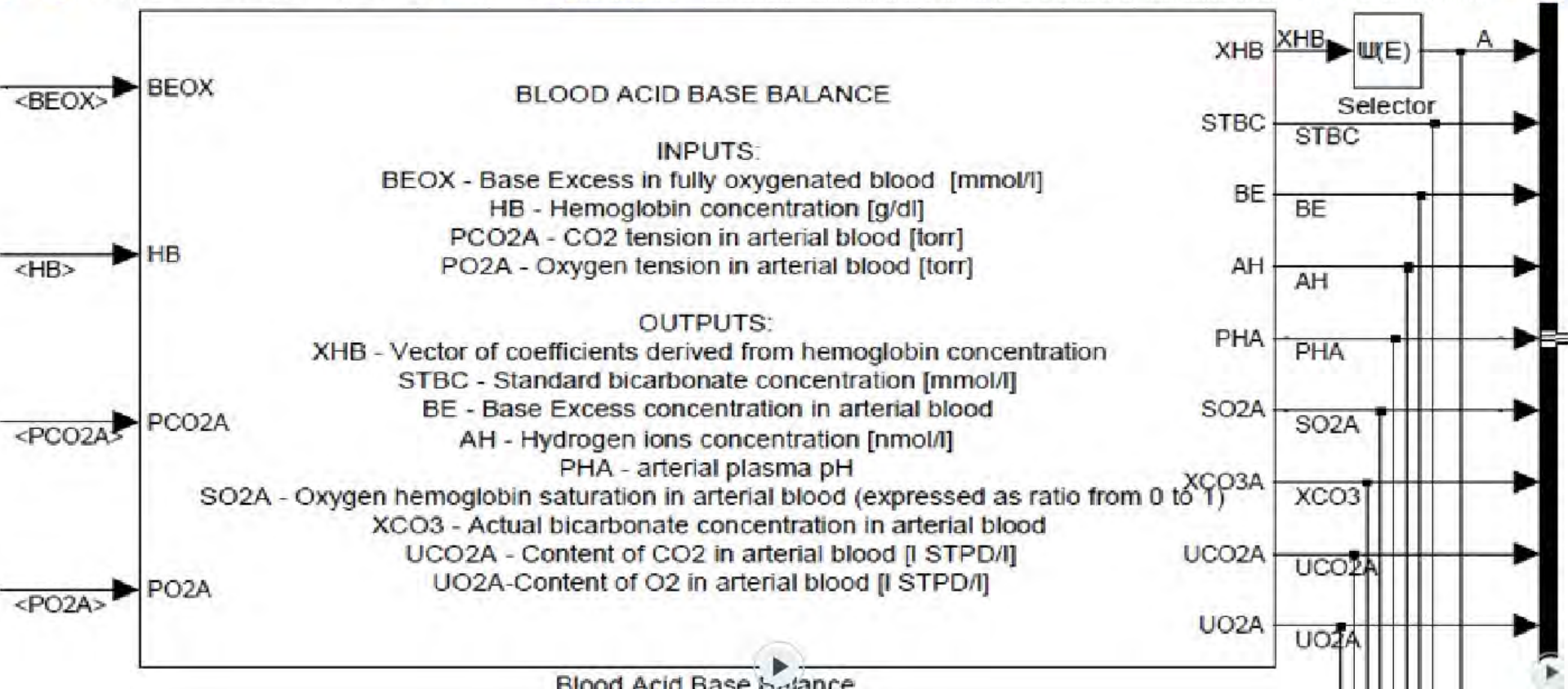




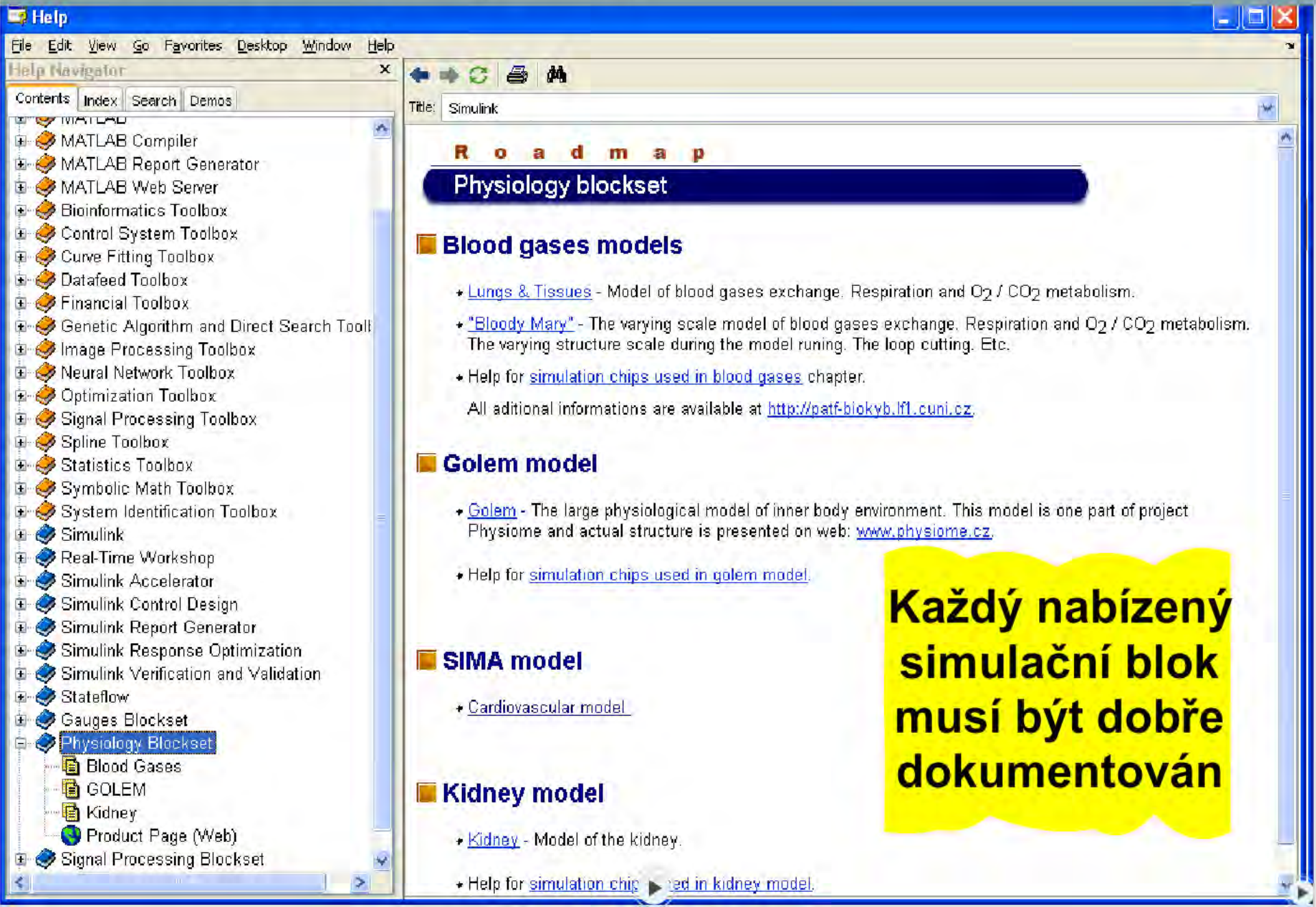
Simulinková knihovna Physiolibrary



Ve veřejně přístupné knihovně PHYSIOLIBRARY je nabídka "simulačních čipů" ke stažení



Simulinková knihovna Physiolibrary



Simulinková knihovna Physiolibrary

Help

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Help Navigator

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- Curve Fitting Toolbox
- Datafeed Toolbox
- Financial Toolbox
- Genetic Algorithm and Direct Search Toolb
- Image Processing Toolbox
- Neural Network Toolbox
- Optimization Toolbox
- Signal Processing Toolbox
- Spline Toolbox
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  - GOLEM
  - Kidney
  - Product Page (Web)
- Signal Processing Blockset
- Support and Web Services

Title: How Simulink Works (Using Simulink)

Physiology blockset - SIMA, Cardiovascular model

SIMA - Cardiovascular model

SIMA CM is an implementation of cardiovascular model according to description in Applied Mathematical Models in Human physiology, Chapter 6. It's assembled from building blocks found in SIMA simulator part of library.

Current version in Physiolibrary serves as a demonstration and provides three outputs:

- Atrial pressure [mmHg]
- Left ventricular pressure [mmHg]
- Left ventricular volume [ml]

Number ouf outputs can be changed easily.

MODELLING THE RESPIRATORY CONTROL SYSTEM IN HUMAN SUBJECTS FOR EXERCISE CONDITIONS

In our model, blood pH is calculated using a model developed by researchers at the University of Prague (Kofranek et al., 2007). The calculation can be regarded as a computer implementation of the Siggaard-Andersen nomogram which was explained in

A THESIS

SUBMITTED TO THE FACULTY OF ENGINEERING

OF THE UNIVERSITY OF GLASGOW

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

Knihovna "simulačních čipů" PHYSIOLIBRARY je využívána

Simulinková knihovna Physiolibrary

Window Help

Title: ref: GOLEM

Help for Physiological Blockset - (blocks references)

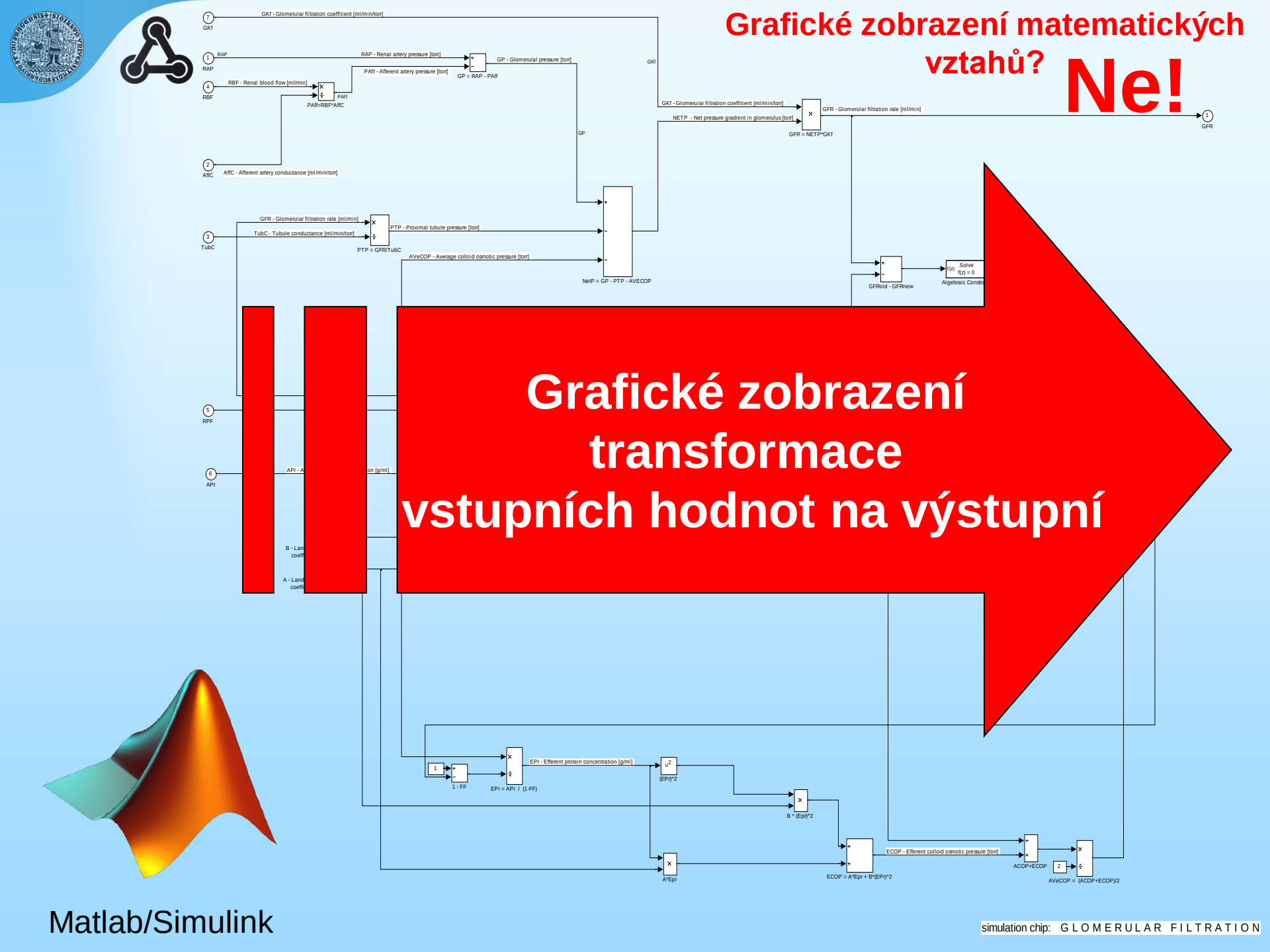
Golem library - Alphabetical List of blocks references

GOLEM Library

- Acid Base Metabolic Balance
- Blood Acid Base Balance
- Blood Glucose Control
- Body Fluid Volume Balance
- Ca & Mg Balance
- Cardiovascular Block
- Chloride Balance
- Controller of Renal Function
- Diuresis & Urine Osmolarity
- Interstitial Pressure and Lymph Flow Rate
- Na & K Balance
- O_2 & CO_2 Exchange

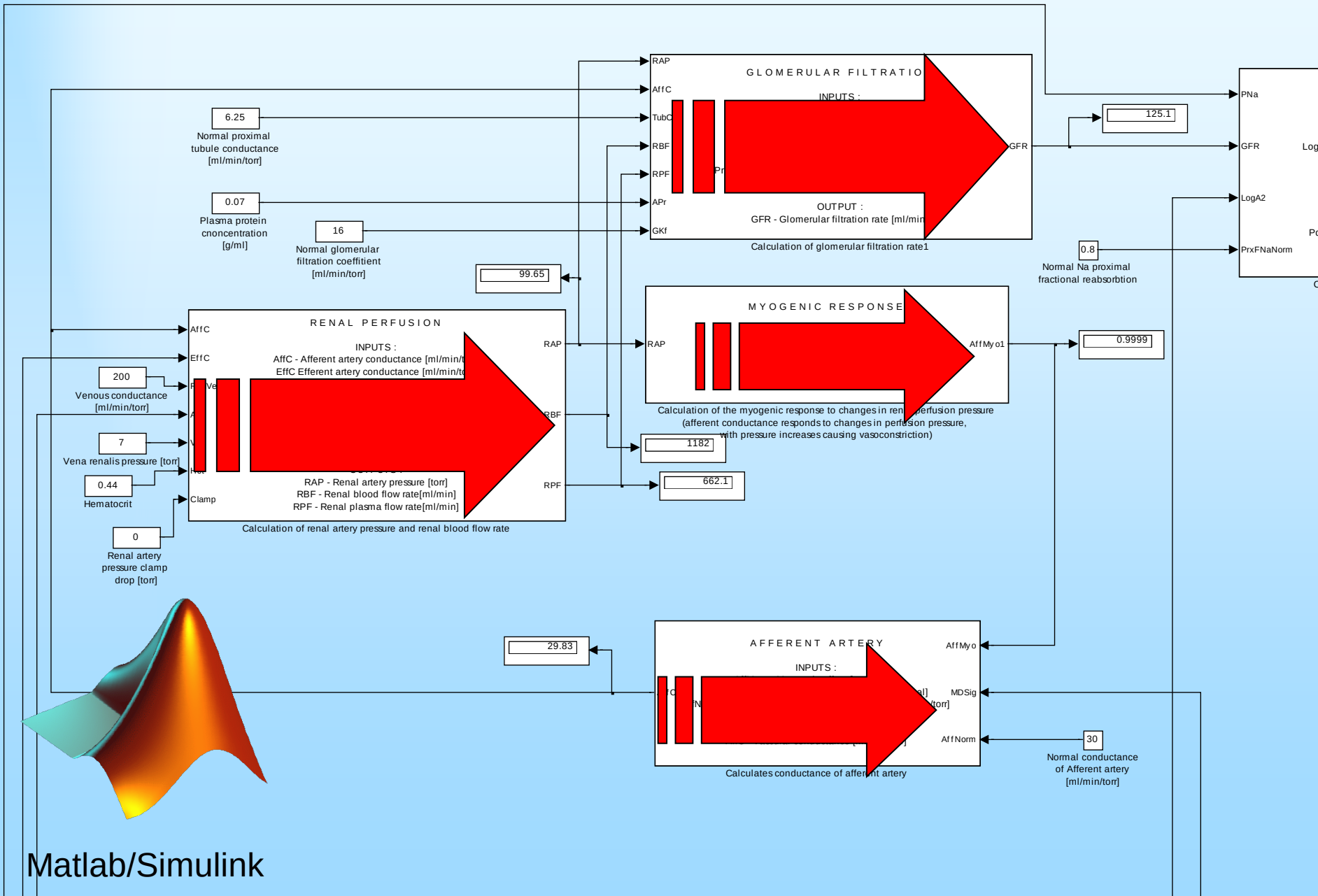
Součástí knihovny PHYSIOLIBRARY je i model, který byl podkladem výukového simulátoru GOLEM

Grafické zobrazení matematických vztahů? Ne!



Matlab/Simulink

Softwarové nástroje pro tvorbu modelů



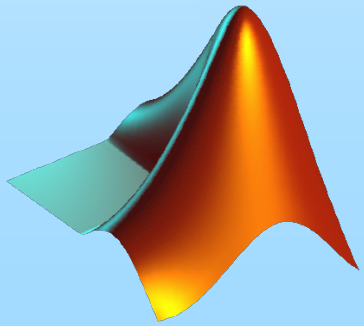
Matlab/Simulink

Kauzální modelovací nástroje

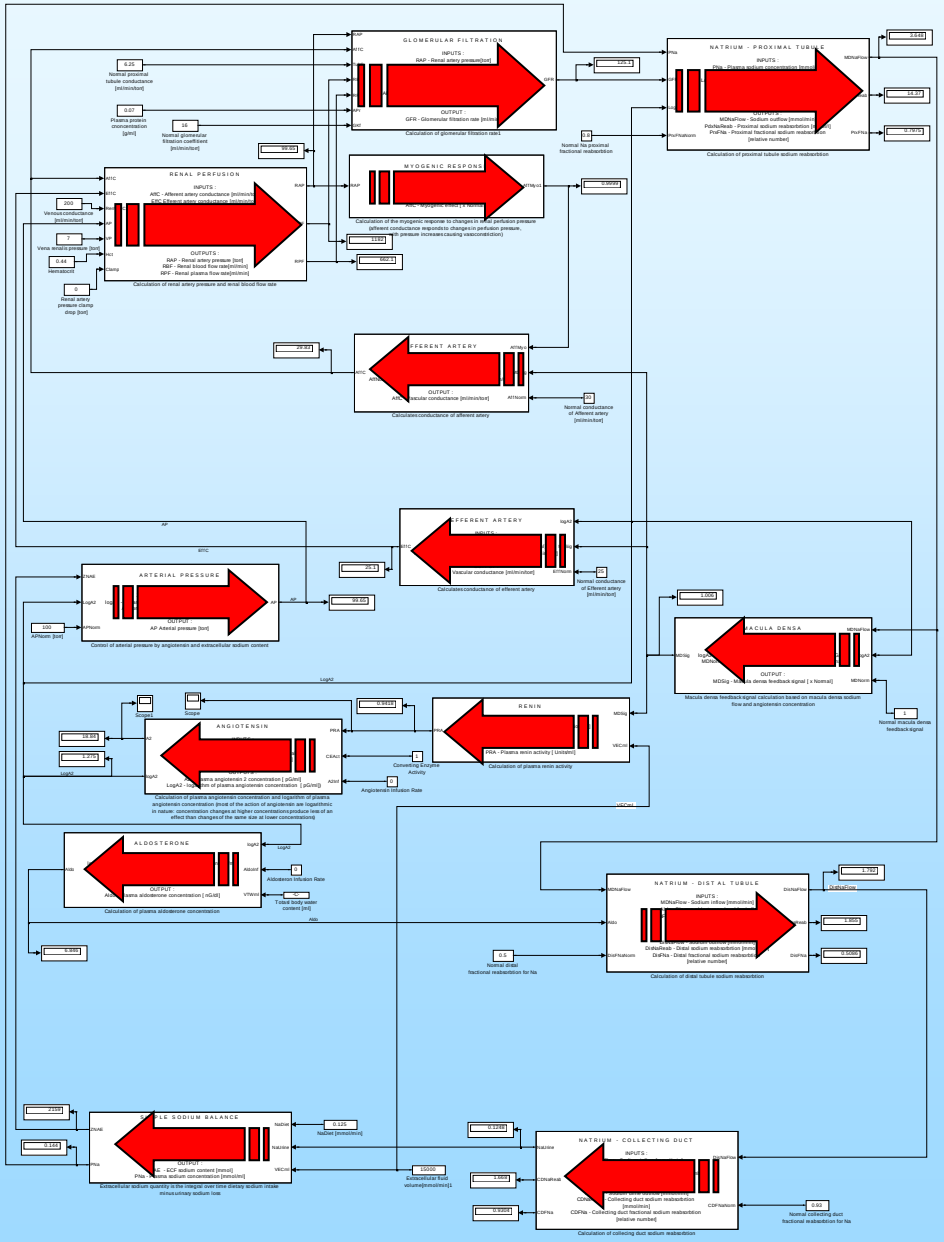
Je jednoznačně definován *postup výpočtu*

Kauzální modelování

Model v Simulinku vyjadřuje spíše *způsob výpočtu* *než* *strukturu modelované reality*



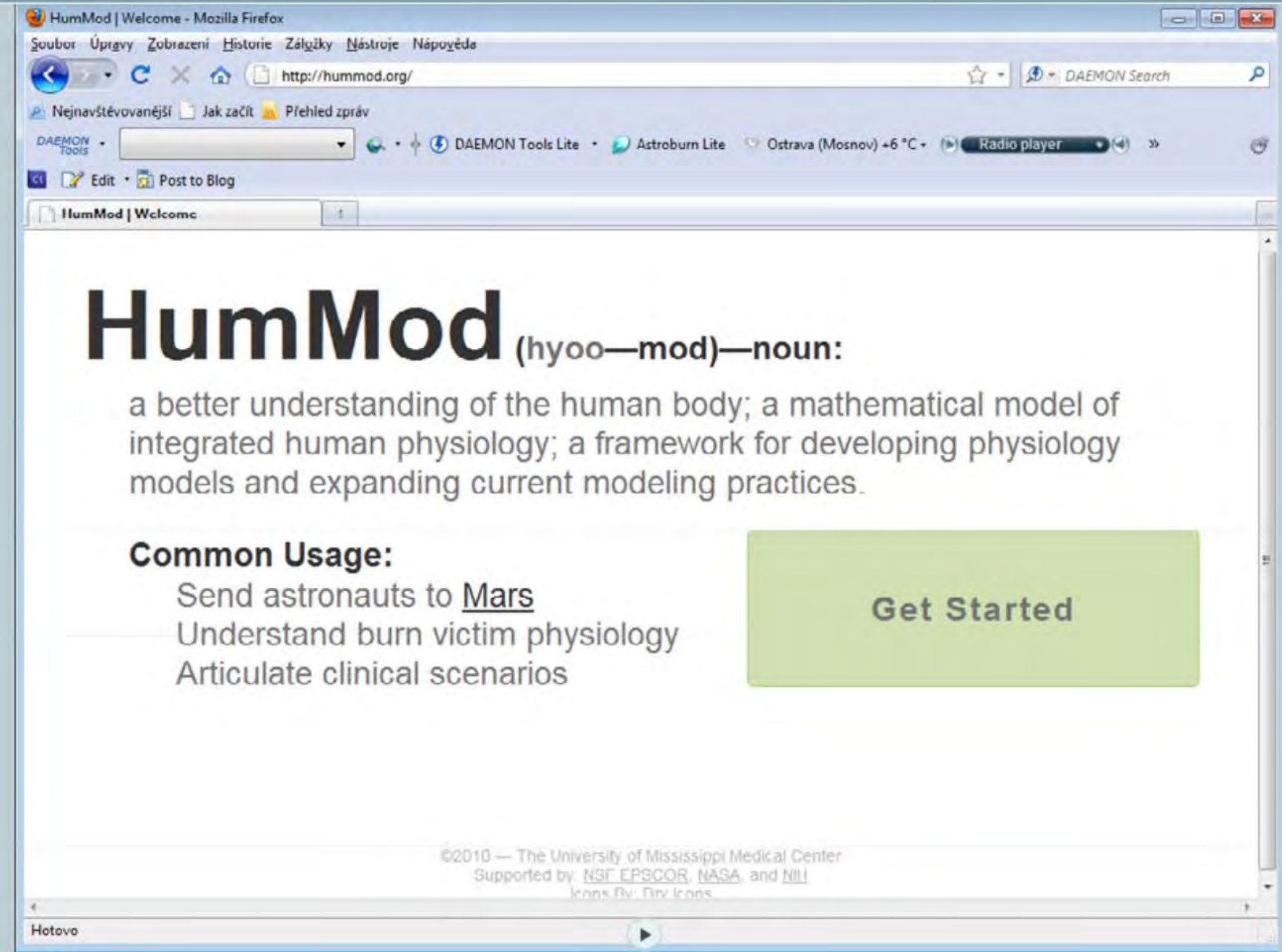
Matlab/Simulink



Modelica pro simulace

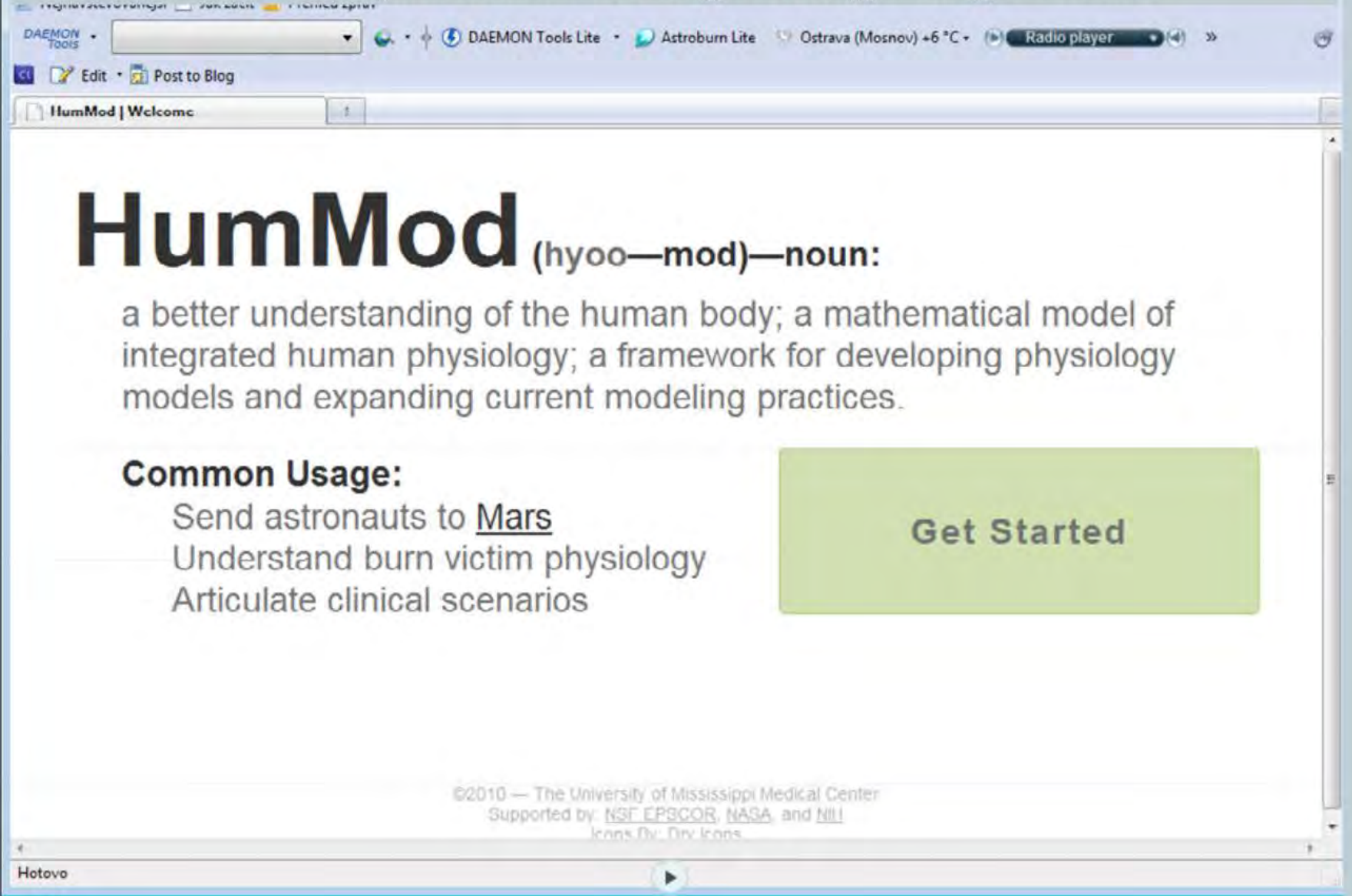
Guytonův model po 40 letech

Model HumMod (QHP - Quantitative Human Physiology)



Model HumMod (QHP - Quantitative Human Physiology)

Model HumMod (Quantitative Human Physiology) je patrně dnes nejrozsáhlejším modelem integrativní fyziologie člověka



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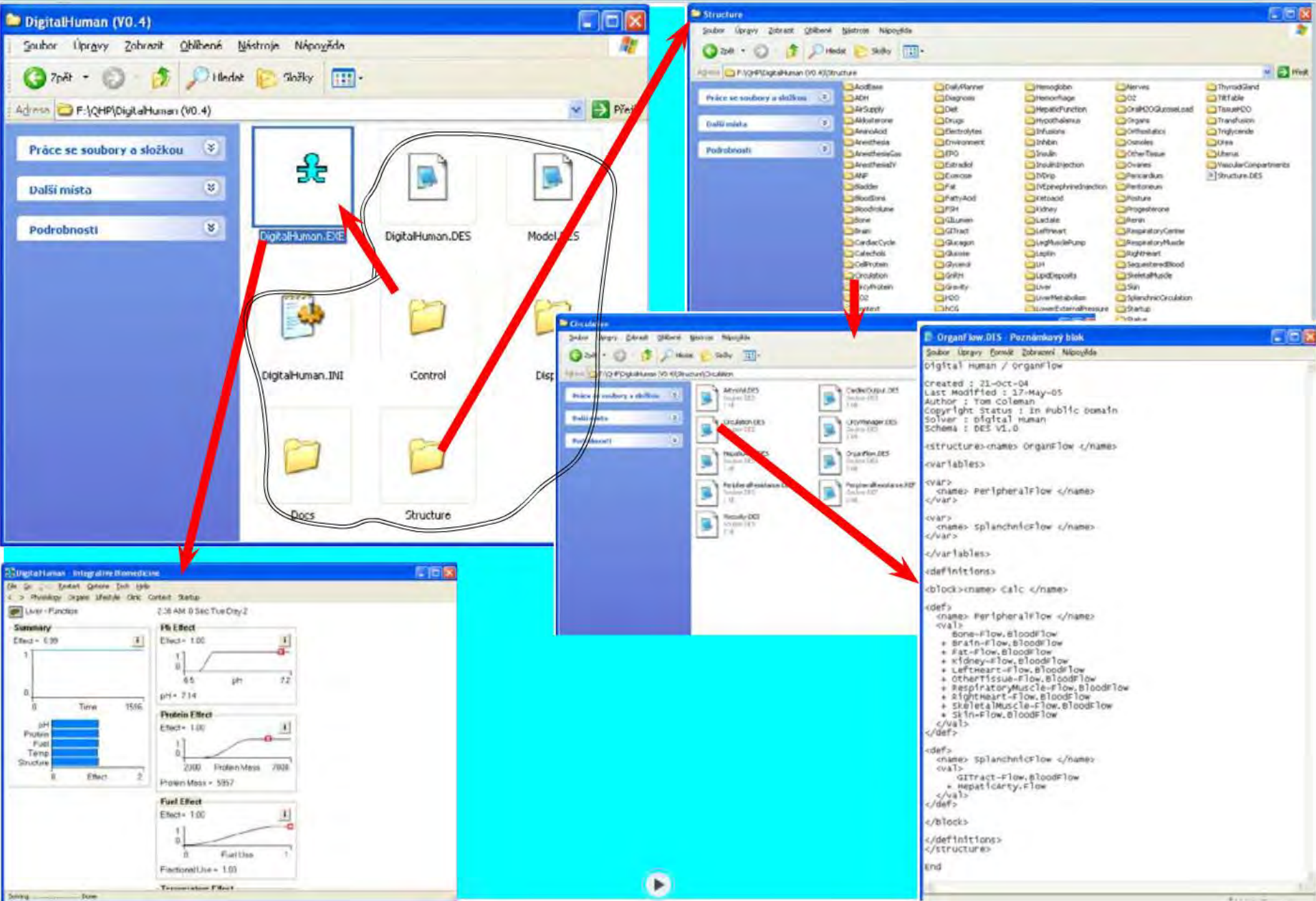

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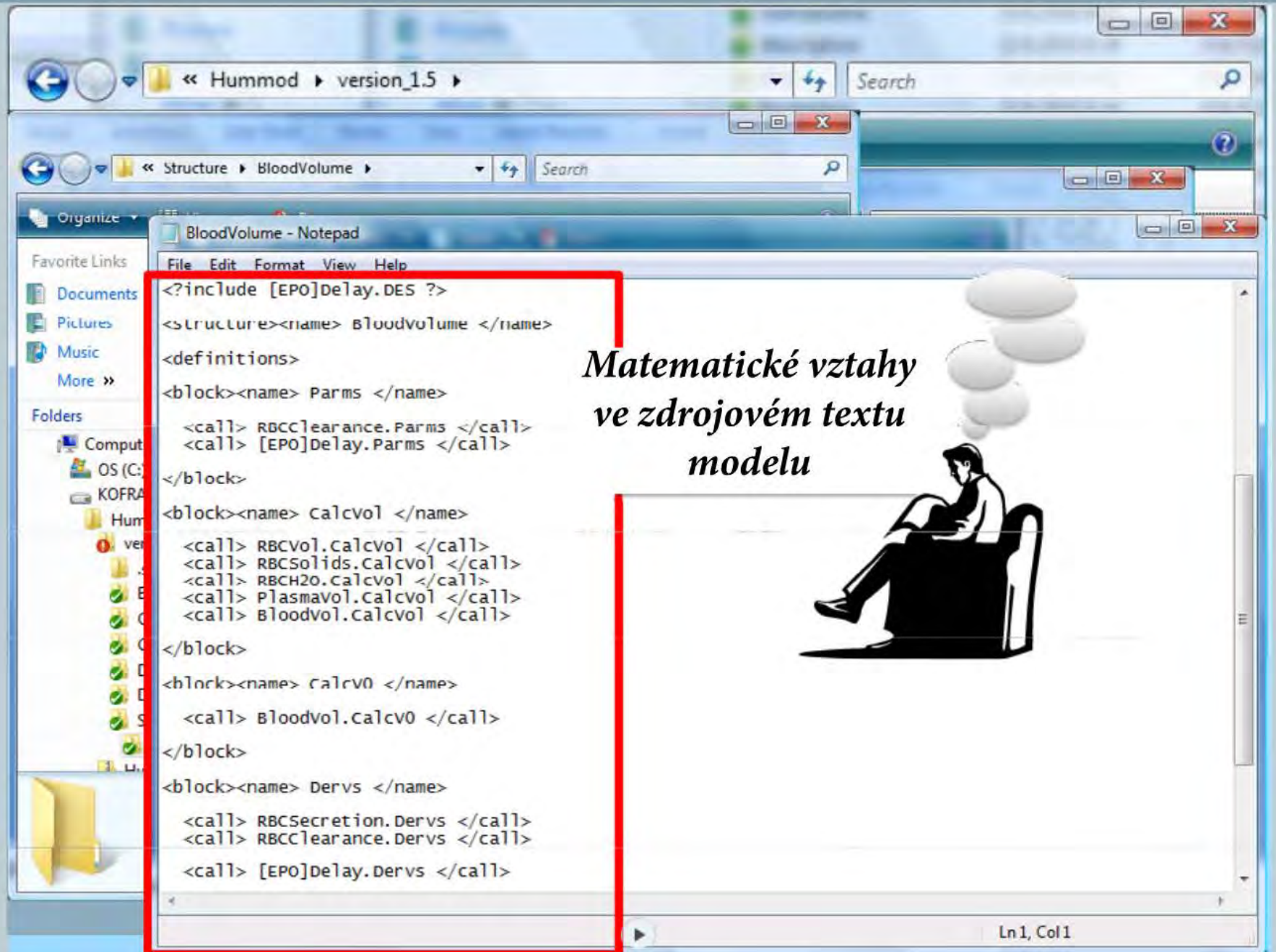

Model HumMod (QHP - Quantitative Human Physiology)

HumMod

Version 1.2.1

Build : Apr 20 2010

University of Mississippi Medical Center
Jackson, MS 39216 USA

Dr. Tom Coleman
Department of Emergency Medicine
support@biosim.com

Dr. Robert Hester
Department of Physiology Biophysics
rhester@physiology.umsmed.edu

Dr. Richard Summers
Department of Emergency Medicine
rsummers@emergmed.umsmed.edu

www.hummod.org

Thomas Coleman - spoluautor původního Guytonova modelu a nyní hlavní architekt modelu HumMod na návštěvě v Praze

Type:	File Folder (.5)
Location:	D:\Hummod
Size:	18,1 MB (19 003 011 bytes)
Size on disk:	59,6 MB (62 525 440 bytes)
Contains:	14 115 Files, 9 674 Folders

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A

Phil. Trans. R. Soc. A (2008) **366**, 3175–3197
doi:10.1098/rsta.2008.0079
Published online 19 June 2008

SAPHIR: a physiome core model of body f homeostasis and blood pres

By S. Randall Th
Jean-Pie

has recently been published (Kofranek & Rusz 2007), not to mention the current very elaborate and comprehensive Quantitative Human Physiology model at the University of Mississippi, directly descended from the early Guyton models by the colleagues of Guyton (Abram *et al.* 2007). The originality of our core model implementation is our commitment to provide documentation for each basic module, interactive modification of any aspect of the model parameters or equations and, especially, the possibility of contributing new detailed local sub-modules to complement or replace selected 'basic modules'. Crucial to this approach is an underlying computational toolbox that is sufficiently robust to handle the wide range of spatial and temporal scales, ar flexible enough to accept sub-modules in a variety of formalisms, including r only ODE/PDE dynamical systems models but also discrete modelling meth

Model HumMod (QHP - Quantitative Human Physiology)

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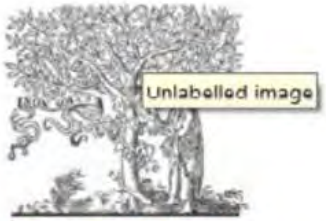

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Graphical simulation environments for modelling and simulation of integrative physiology

Violeta Mangourova[a,*], *John Ringwood*[a], *Bruce Van Vliet*[b]

[a] *Dept. of Electronic Engineering, NUI Maynooth, Ireland*
[b] *Biomedical Sciences Division, Memorial University, St. John's, Newfoundland, Canada*

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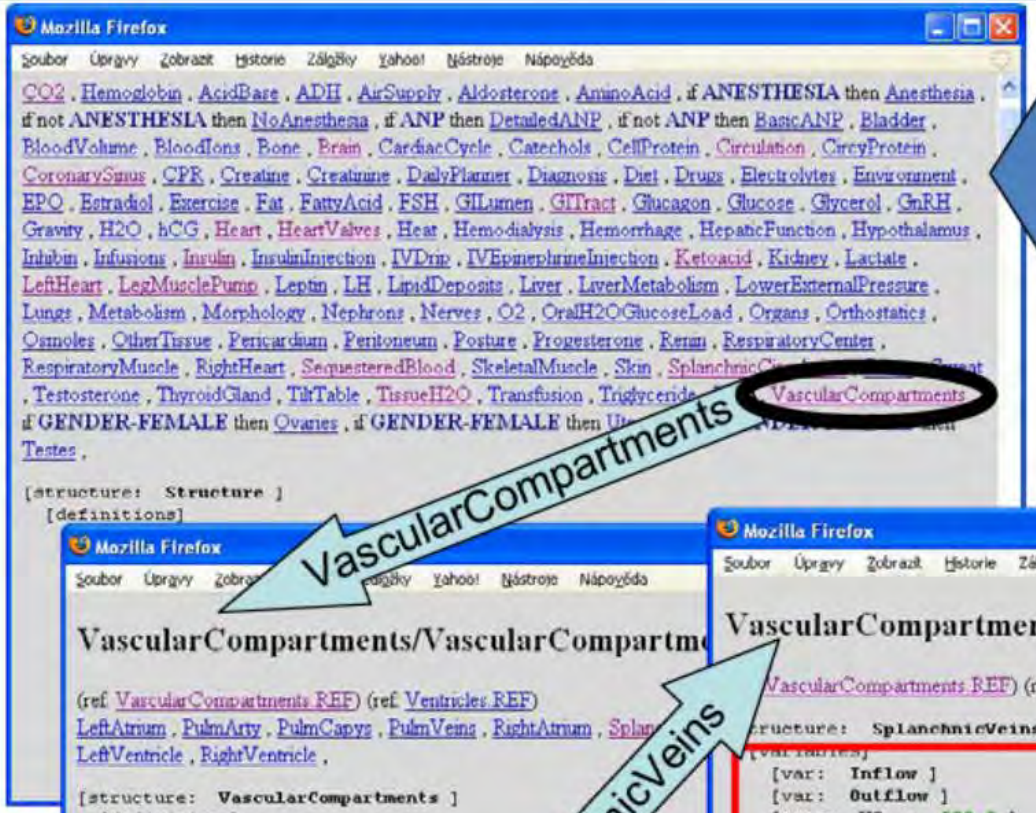
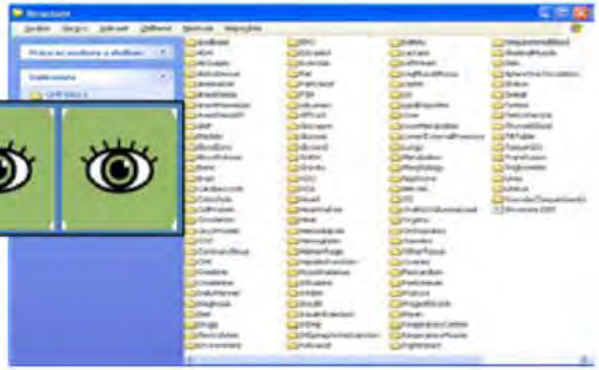
makes the wider interactions in the model difficult to visualise. Coleman's extension of Guyton's work [5] via the QHP (Quantitative Human Physiology) model was available only in executable form (for teaching purposes) until recently, when an eXtensible Markup Language (XML) version of the model was released [6,7]. This extended model, however, is difficult to read and visualise, since no diagrammatic form exists.

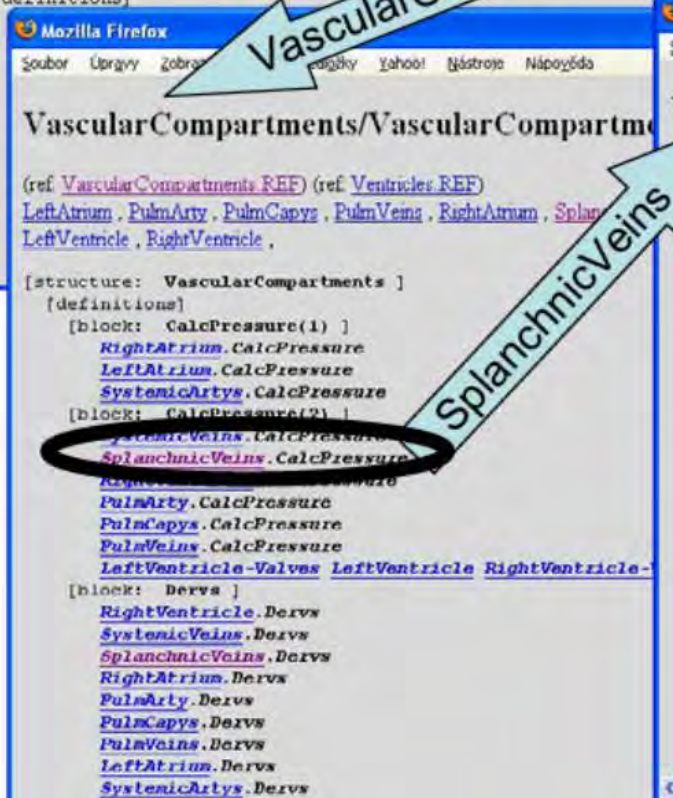
Model HumMod (QHP - Quantitative Human Physiology)



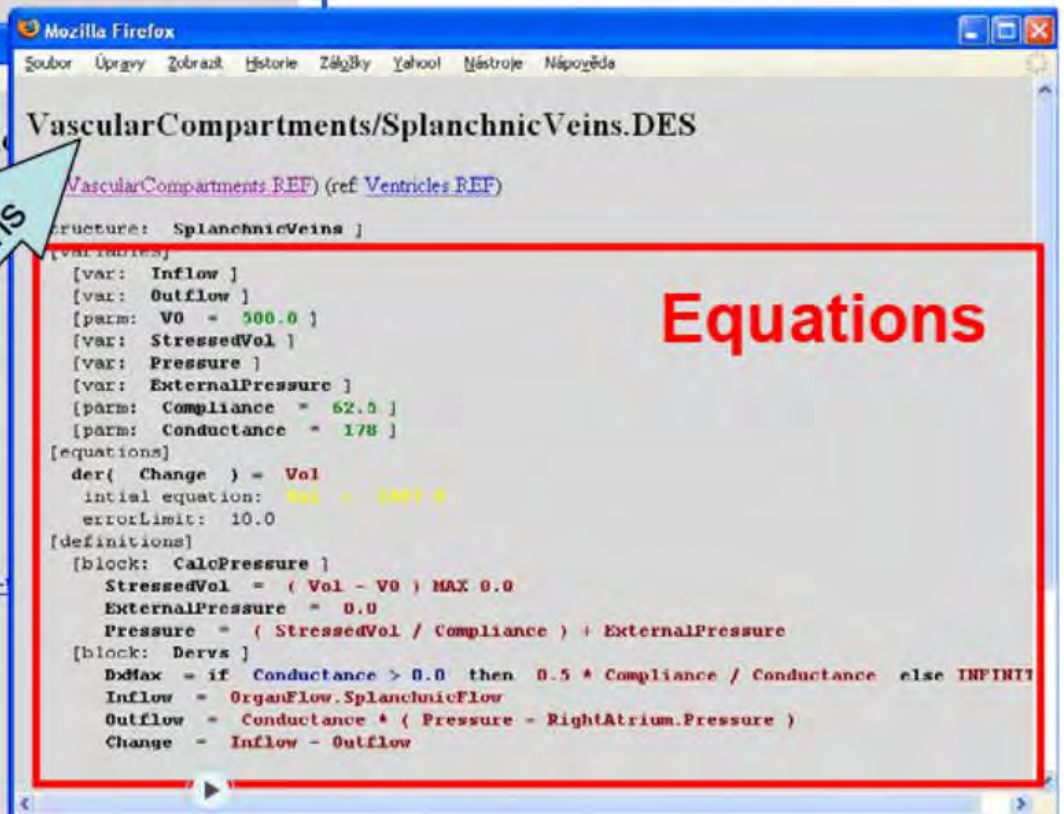


QHPView

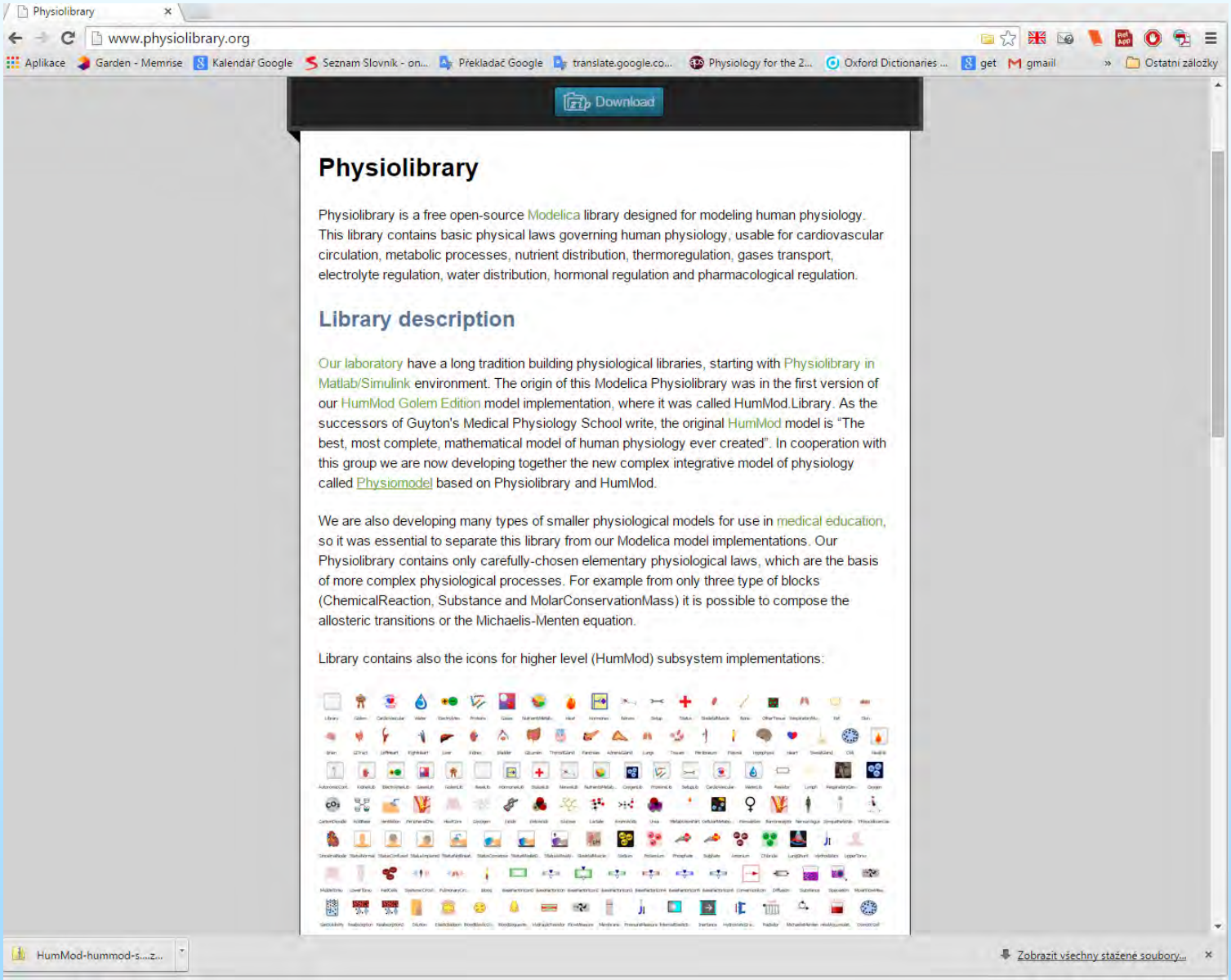
VascularCompartments



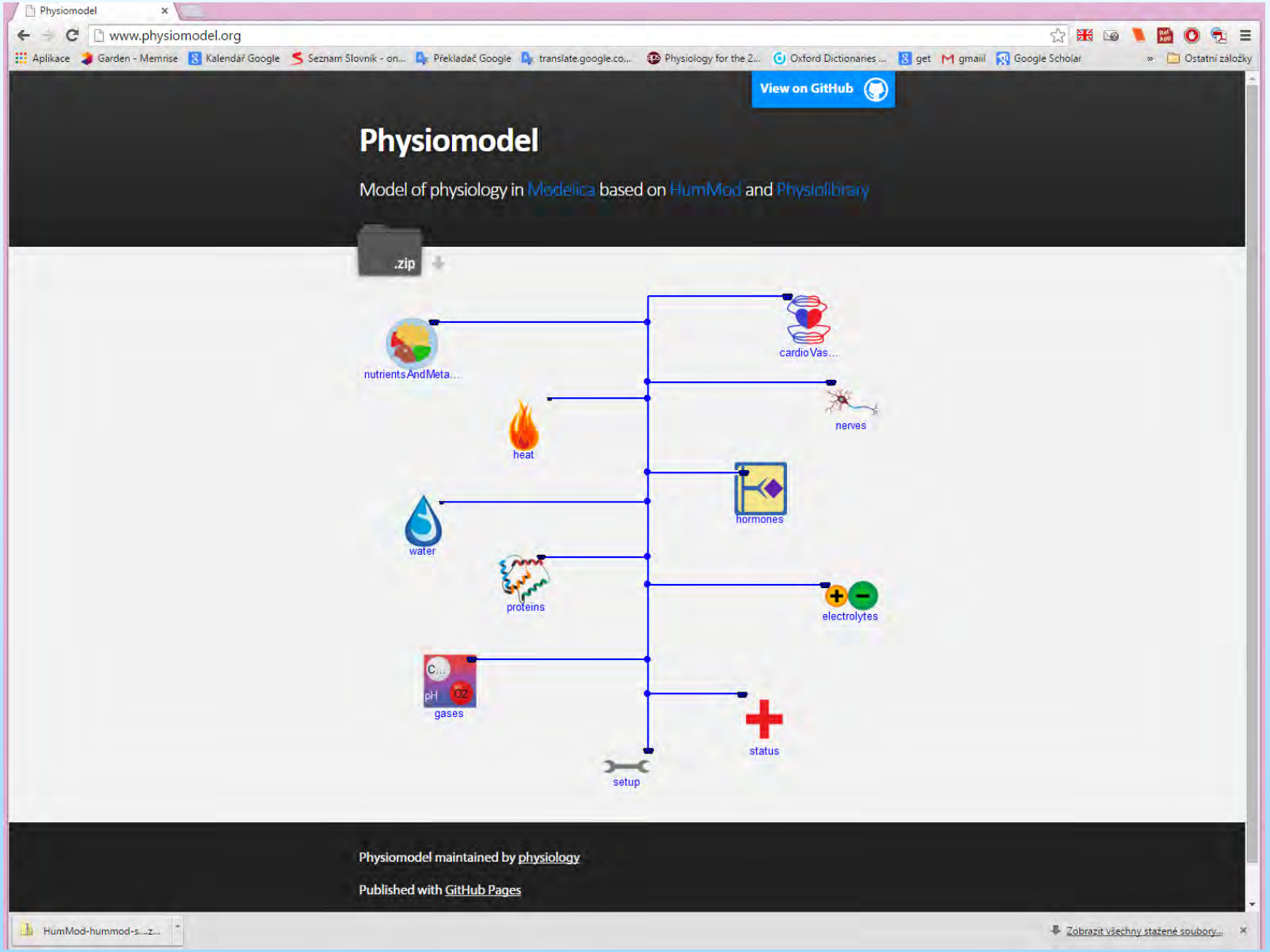
SplanchnicVeins



Equations



Modelica pro simulace



Modelica pro simulace

Děkuji za pozornost

kofranek@gmail.com