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37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society

## Template for Preparation of Proposal for EMBC 2015 **Tutorials**

**Type** Half day

**First A. Proposer-** Tomas Kulhanek, EMBS Member

**Biographical Sketch** of the Proposer (3 lines max)

Tomas holds MSc in Computer Science from the Charles University in Prague. He worked 9 years in IT industry in software development. Since 2011 Tomas is a full-time researcher at First Faculty of Medicine Charles University in Prague focusing on grid and cloud computing and computational physiology.

**Second B. Proposer** -Jiri Kofranek, EMBS Member

**Biographical Sketch** of the Proposer (3 lines max)

Jiri holds MD and PhD in Physiology from Charles University in Prague. He is reader at First Faculty of Medicine at Charles University in Prague and provides lectures about modeling and simulation for students of biomedical engineering. His long term research focus is toward new technologies for education of medicine and biomedical engineering.

**TITLE Modeling complex models of physiology in Modelica and Physiobrary**

**Theme** (chose one of the 12 Conference Themes):

• *Bioinformatics and Computational Biology, Systems Biology, & Modeling Methodologies*

**Keywords** (Max 5)

modeling, physiology, acausal, object-oriented, Modelica

**Abstract— Write here the Abstract text. Max 300 Words**

Physiobrary (<http://www.physiobrary.org>) is an open-source Modelica library usable for mathematical modeling of cardiovascular circulation, metabolic processes, nutrient distribution, thermoregulation, gases transport, electrolyte regulation, water distribution, hormonal regulation and pharmacological regulation mainly for the lumped-parameter approach. Together with participants we want to demonstrate many examples of how to use it for research and educational purposes. and howto build complex models of physiology using basic components that are already prepared for it. Modelica standard is supported by association composed from industrial as well as academical members and it is implemented by commercial as well as open-source tools. First part of workshop will introduce acausal and object oriented Modelica language using opensource tools OpenModelica and commercial tool Dymola. The second part of the workshop will consist of hands-on sections that will demonstrate building selected models of 1) cardiovascular system dynamics - using hydraulic domain. 2) common biochemical reactions - using chemical domain. 3) body thermal transfers with blood flow using thermal domain 4) liquid volume of the penetrating solution in intracellular space, extracellular space, interstitial space, blood plasma or cerebrospinal fluid using osmotic domain 5) integrative approach which connects these models together. The Physiobrary <http://www.physiobrary.org> is currently used to model the most complex model of human physiology PhysioModel <http://www.physiomodel.org/> Attendees should bring their own computers to participate in the hands-on sections of the tutorial.

**LIST of Speakers**

*A. First A. Speaker, Tomas Kulhanek, Charles University in Prague, [tomas.kulhanek@lfl.cuni.cz](mailto:tomas.kulhanek@lfl.cuni.cz)*

**Title of the presentation – Basic modeling techniques in Modelica language using Physiobrary**

**Biographical sketch of the Speaker – see biographical sketch of the proposer**

*B. Second B. Speaker, Marek Matejak*

**Title of the presentation – Advanced topics and integrative models of physiology**

**Biographical sketch of the Speaker**

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F. A. Proponent, is with the Charles University in Prague, First Faculty of Medicine, U Nemocnice 5, 128 53 Praha 2, Czech Republic(corresponding author to provide phone: +420-775178931; e-mail: [tomas.kulhanek@lfl.cuni.cz](mailto:tomas.kulhanek@lfl.cuni.cz)).

S. B. Proponent, is with the Charles University in Prague, First Faculty of Medicine, U Nemocnice 5, 128 53 Praha 2, Czech Republic(e-mail: [kofranek@gmail.com](mailto:kofranek@gmail.com)).



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Marek Matejak holds Msc in Computer Science from Charles University in Prague and currently is finishing his PhD about integrative modeling of physiology in Department of Pathophysiology at First Faculty of Medicine, Charles University in Prague. He is main author and architect of Physiobrary and the complex model of physiology in Modelica Physiomodel.