Special Issue on Medical Imaging in Computational Physiology
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According to the STEP research roadmap (http://www.europhysiome.org) the Virtual Physiological Human (VPH) is *a methodological and technological framework that once established will enable the investigation of the human body as a single complex system*. Underlying the VPH concept, the International Union for Physiological Sciences (IUPS) has been sponsoring for more than a decade now the IUPS Physiome Project (http://www.physiome.org.nz), which is a *worldwide public domain effort to provide a computational framework for understanding human physiology*. It aims to develop integrative models at all levels of biological organization, from genes to the whole organism via gene regulatory networks, protein pathways, integrative cell function, and tissue and whole organ structure/function relations.

In this context, the roles of medical imaging and image computing play, and will continue to play, an increasingly important role as they provide systems and methods to image, quantify and fuse both structural and functional information of the human being *in vivo*. These two main research areas include the transformation of generic computational models to represent specific subjects thus paving the way for personalized computational models. Individualization of generic computational models through imaging can be realized in three complementary directions: a) definition of the subject-specific computational domain (anatomy) and related subdomains (tissue types); b) definition of boundary and initial conditions from (dynamic) imaging; and c) characterization of the structural and functional tissue properties. In addition, imaging has also a pivotal role in the evaluation and validation of such models both in human and in animal models, and in the translation of such models to the clinical setting with both diagnostic and therapeutic applications.

The applications of image-based VPH/Physiome models in basic and clinical domains are vast but, broadly speaking, they hold the promise to become new virtual imaging techniques. Effectively more, and often non-observable, parameters will be imaged *in silico* based on the integration of observable but sometimes sparse and inconsistent multimodal images and physiological measurements. Computational models will serve to engender interpretation of the measurements in a way compliant with the underlying biophysical, biochemical or biological laws of the physiological or pathophysiological processes under investigation. Ultimately, such investigative tools and systems will help our understanding of disease processes, the natural history of disease evolution, and the influence on the course of a disease of pharmacological and/or interventional therapeutic procedures.

We invite submission of papers describing new methods and tools for image-based approaches to the VPH/Physiome. The special issue will give particular attention to contributions describing methods and tools combined with a thorough clinical evaluation. Suggested topics include but are not restricted to:

- Image-related ontologies to organize biomedical knowledge and their cross-linkage to image databases.
- Markup languages to encode image-derived models of human and biological structure and function in a standard format for sharing between different application programs and for re-use as components of more comprehensive models.
- Image databases providing access to structural/functional information at the cell, tissue, organ and system levels.
- Methods to render and integrate image information with computational models of cell function such as ion channel electrophysiology, cell signaling and metabolic pathways, transport, motility, the cell cycle, etc. in 2D and 3D graphical form.
- Techniques for 1) displaying and interacting with organ and system models, across all spatial and temporal scales and including multiscale applications; 2) image-based non-invasive estimation of fine structure, tissue distribution and material properties in order to personalize computational models; and 3) efficient and high-throughput pre- and post-processing of image-based computational models.
- Applications of computational models for 1) subject-specific interventional planning and therapy customization; 2) *in silico* understanding of disease processes and their progression; and 3) design, assessment and optimization of medical devices and products in *in silico* populations derived from image information.
- Applications of large-scale modeling and simulation studies involving imaging information and enabling computational technologies (e.g. grid computing, high-performance computing, distributed databases, etc.).

Submission deadlines and expected decision dates:

Submission of manuscripts:	February 1, 2012
First acceptance/rejection notification:	May 1, 2012
Revised manuscripts due:	July 1, 2012
Final acceptance/rejection notification:	September 1, 2012
Publication of Special Issue:	January 2013

T-MI seeks high quality research papers for this special issue. This special issue will welcome full-paper submissions. Authors should submit their manuscripts electronically, by the deadline above, through the ScholarOne Manuscripts following the IEEE TMI instructions for authors and indicating in the author's cover letter that the manuscript be considered for the special issue on Medical Imaging in Computational Physiology. Articles received after the due date will be reviewed, but may not be reviewed in time for inclusion in the special issue. Accepted papers not included in the special issue will be published in regular issues of TMI. Authors intending to submit articles are encouraged to discuss their submissions with the Guest Editors first to determine suitability for this special issue. The Guest Editors will screen submitted papers for suitability for this special issue. Papers not deemed suitable for the special issue will be forwarded to the Editor-in-Chief of TMI for possible consideration as regular submissions to TMI.

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