6th International Conference on Computational and Mathematical Biomedical Engineering - CMBE2019
10–12 June 2019, Japan
P. Nithiarasu, M. Ohta and M. Oshima (Eds.)

PREDICTIVE COMPUTATIONAL VASCULAR MECHANICS

T.C. Gasser*, M.W. Gee and D. Valdez-Jasso*****
*KTH, Royal Institute of Technology, Stockholm, Sweden, gasser@kth.se
**Technical University of Munich, Munich, Germany, gee@tum.de
***University of California San Diego, San Diego, USA, dvaldezjasso@eng.ucsd.edu

MINI-SYMPOSIUM PROPOSAL

Keywords: *Computational Vascular Mechanics, Parameter Identification, Uncertainty Quantification, Inverse Analysis, Predictive Modeling*

Computational Mechanics meanwhile plays a prominent role in the analysis and modeling of the human vascular system and its diseases. Simulations of the vascular mechanical system and its interaction with the biological processes can advance the understanding of physiological and pathological mechanisms and may open a door to the development of new treatment options and medical devices. Though classical mechanical concepts of course hold, they are challenged by quite a few aspects when applied to problems that incorporate living tissue material and in vivo patient specific geometries: There usually exist a large uncertainty and variation in (highly nonlinear and anisotropic) material properties, a multiscale nature of the materials at hand, a lack of access to samples for experimental testing, a clear definition of a reference frame, difficulties in geometry capturing and the mechano-biochemical interplay, where mass conservation and time-constant material properties are not guaranteed, just to name a few. Therefore, robust and efficient numerical models are needed that appropriately consider the complex interplay between the various involved fields, such as solids, fluids, transport and diffusion, biochemical and electrical processes involved. Additionally, appropriate data capturing, quantification of the uncertainties and modeling error involved, is necessary to build trust and applicability of computational models to real world clinical questions and problems and to drive development of new treatment techniques and diagnostic tools.

Therefore, this minisymposium on computational vascular mechanics focuses on aspects that are necessary to achieve predictive capability and hence clinical relevance. Among these, in the context of computational vascular multiphysics, there are

- Uncertainty quantification and large patient cohorts
- Inverse methods and parameter identification
- Reduced order models of clinical relevance
- Patient-specific constitutive modeling
- Multifield methods in a patient-specific context
- Multiscale methods applied to real world problems
- Integrated imaging & computation approaches
- Development and validation of boundary conditions
- Real-time computational mechanics