

COMPUTATIONAL STUDIES OF CARDIOVASCULAR AND IMMUNE SYSTEMS IN NORMAL AND PATHOLOGICAL CONDITIONS

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MINI-SYMPOSIUM PROPOSAL

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Biological fluid flows and their interaction with the adjacent tissues are involved in normal and pathological functioning of many physiological processes. Mathematical and numerical modelling of such processes require the development of multi-scale and multi-physics models in order to describe dynamics of complex fluids, fluid-structure interaction, transport processes and metabolism, biochemical reactions in liquid and solid phases, dynamics of cell and pathogen populations. These and other processes determine physiological response of the organism and they should be studied in their interaction.

This minisymposium will be devoted to the mathematical modelling and numerical simulations of flows in cardiovascular and immune systems and their mechanical and biochemical interactions with the surrounding tissues. It will include the following topics:

- Methods of flows modelling (3D flows in complex structures, cells based models, 1D global models, fluid-structure interaction), transport processes and metabolism modelling;
- Methods of modelling flows in porous deformable media and fluid-tissue interaction;
- Biochemical reactions in plasma, coagulation cascade, the influence of blood flow on clot growth, thrombosis and other disorders related to blood coagulation;
- Atherosclerosis, biochemical reactions in vessel walls, development of chronic inflammation, plaque formation, fluid plaque interaction, plaque rupture, the influence of blood flow on atherosclerosis development;
- Structure of biological tissues including blood vessel walls, lymphoid organs, integration of conduit system and microvascular network in lymph nodes;
- Infection and inflammation spread in the tissues, tissue destruction and remodelling, fibrosis, immune response, cell migration and homing, drug and cytokine pharmacokinetics;
- Process coupling across multiple scales, methodology of hybrid modelling.

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