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Lung Biomechanical Modeling and Simulation

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MINI-SYMPOSIUM PROPOSAL

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LUNG BIOMECHANICAL MODELING AND SIMULATION

Lung biomechanics has been extensively studied by physiologists, experimentally as well as theoretically, from the air flow [1], blood flow [2] and tissue stress [3] points of view, laying the ground for our current fundamental understanding of the relations between function and mechanical behavior. However, many questions remain, notably in the intricate coupling between the multiple constituents—tissue, blood and air—, between the many phenomena taking place at different spatial and temporal scales in health and disease. These questions pose real challenges, as pulmonary diseases are an important health burden, as exemplified by Chronic Obstructive Pulmonary Disease (COPD), the most common pulmonary disease, which is about to become the third cause of death in the world [4].

Modern modeling and simulation tools can help strengthen and improve our understanding of the lung biomechanics in an objective and quantitative manner, as well as improve the sensitivity and specificity of disease diagnostics, paving the way toward computer-aided decision making in medicine. But specific scientific challenges lie on this path, which are being addressed by a rather diverse community. They include notably: the representation and handling of the complex fractal/hierarchical lung microstructure [5], [6]; the fluid-fluid-structure interaction [7], either explicitly or homogenized into poro-mechanics theories [8]; the interaction with external organs such as the heart, the diaphragm or the ribcage [9]; the coupling between modeling and/or experimental data at various scales [10].

The objective of this mini-symposium is to gather and structure this community, provide an overview of the current state of the art in the field, and pinpoint the main theoretical and practical bottlenecks faced by the community.

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