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LUNG BIOMECHANICS: MULTISCALE AND MULTIPHYSICS MODELLING

Hari Arora* and Mona Eskandari†
*Zienkiewicz Centre for Computational Engineering, Faculty of Science and Engineering, Swansea University, hari.arora@swansea.ac.uk, †Department of Mechanical Engineering, BREATHE Center School of Medicine, University of California at Riverside, eskandar@ucr.edu

MINI-SYMPOSIUM PROPOSAL

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COVID-19 has focused significant attention on pulmonary biomechanics research. Even before this respiratory-targeting pandemic, disease affecting the lung (e.g. asthma, COPD, pulmonary fibrosis, etc.) were collectively the leading cause of morbidity and mortality worldwide, and yet pulmonary research remains an under-developed. Computational models of the lung require experimental data to inform construction; Recent strides in imaging and material characterization [1, 2], both in vivo and ex vivo, at the organ [3], tissue [4], and microstructural [5] level has enabled the measures necessary for the formulation of novel pulmonary simulations. Models are often disconnected, synthetically siloing pulmonary behavior, such as bulk organ inflation, airway, and parenchyma structures, the lung is a complex system with multiple mechanical schemes in place (i.e. fluids versus solids) in addition to its multiscale nature. This mini-symposium is intended to invite computational research highlighting any and all aspects of lung biomechanics, whether focused on one structure or an aspect of lung modelling or more broad in approach. This mini-symposium aims to facilitate a comprehensive representation and review of pulmonary modeling within the community today.

The objective of this mini-symposium is to spark discussions centered on devising new techniques or adapting traditional methods to formulate computational lung models which are both accurate and enable interactions across the scales. Physiologically accurate simulations of the lung system can set the stage for future optimization of surgical interventions, assessment of patients' response to treatment, and serve as possible diagnostic methods, to ultimately improve pulmonary medicine and patient care.

REFERENCES

[1] Arora, H., Nila, A., Vitharana, K., Sherwood, J.M., Nguyen, T.T.N., Karunaratne, A., Mohammed, I.K., Bodey, A.J., Hellyer, P.J., Overby, D.R. and Schroter, R.C., 2017. Microstructural consequences of blast lung injury characterized with digital volume correlation. *Frontiers in Materials*, *4*, p.41.
[2] Eskandari, M., Nordgren, T.M. and O'Connell, G.D., 2019. Mechanics of pulmonary airways: linking structure to function through constitutive modeling, biochemistry, and histology. *Acta biomaterialia*, *97*, pp.513-523.
[3] Herrmann, J., Lilitwat, W., Tawhai, M.H. and Kaczka, D.W., 2020. High-frequency oscillatory ventilation and ventilator-induced lung injury: size does matter. *Critical Care Medicine*, *48*(1), pp.e66-e73.

[4] Sera, T., Kuninaga, H., Fukasaku, K., Yokota, H. and Tanaka, M., 2019. The effectiveness of an averaged airway model in predicting the airflow and particle transport through the airway. *Journal of aerosol medicine and pulmonary drug delivery*, *32*(5), pp.278-292.
[5] Concha, F., Sarabia-Vallejos, M. and Hurtado, D.E., 2018. Micromechanical model of lung parenchyma hyperelasticity. *Journal of the Mechanics and Physics of Solids*, *112*, pp.126-144.