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COMPUTATIONAL MODELING FOR MULTISCALE BIOLOGIVAL HEAT AND MASS TRANSFER PHENOMENA

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Mini-symposium proposal

Keywords: Human thermal model; Selective brain hypothermia; MD simulation; Oxygen transport; Microcirculation complications; Capillary network; Blood perfusion; Tumor treatment; Nano-particle; Drug delivery

During the past several decades, there has been an increasingly intense interest in bioheat and mass transfer phenomena, with particular emphasis on therapeutic and diagnostic applications. Owing to the development of computational techniques, extensive multidisciplinary and multiscale approaches have been developed to analyze different kinds of bioheat and mass process. For example, an integrated model of the human thermal and respiratory systems can give the distribution of the temperature, O2 and CO2 in blood and tissues for different physical exercise levels. The influence of aging on blood flow and temperature was well predicted by a 1D cardiovascular-tissue conduction-thermoregulatory model. Brain temperature can be precisely managed by coupling an adaptive control method and heat transfer process in selective brain hypothermia. Blood flow, tumor size, and thermophysical properties can be estimated from the known skin temperature by using various inverse algorithms. On the other hand, there are a variety of modeling studies for microcirculation focusing on blood flow, vasomotion, and drug delivery, in which oxygen and nitric oxide transport inside and among cells is of extremely importance. Molecular dynamics simulation provides valuable insights into mechanisms of the interaction between nanoparticles and thermo-fluid flow in biological tissues.

The mini-symposium is aimed at presenting the most recent developments and research efforts in the field of bioheat and mass transfer in micro and macro scales, in order to provide the advances of scientific knowledge in this field and the opportunities for exchange of ideas among physiologists, clinicians, and engineering researchers. We will also welcome presentations of experimental results, such as in-vivo and in-vitro measurements.

REFERENCES

[1] C. Albuquerque, J.I. Yanagihara, An integrated model of the thermoregulatory and respiratory systems of the human body, Int Comm. Heat & Mass Trans, 2020, vol. 116:104683
[2] A. Coccarelli et al, Influence of ageing on human body blood flow and heat transfer: A detailed computational modelling study, Int. J. Num. Meth. Biomed. Eng., https://doi.org/10.1002/cnm.3120.
[3] Wang, YP, Tang YL, and He, Y, Numerical analysis of the influence of RBCs on oxygen transport within a tissue with an embedded capillary network, J. Mechanical Eng. Sci., http://dx.doi.org/10.1177/0954406220954482