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COMPUTATIONAL MODELS FOR HYPERTENSION STUDIES

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MINI-SYMPOSIUM PROPOSAL

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Hypertension is a long-term medical condition in which arterial blood pressure is persistently elevated. Despite rarely causing noticeable symptoms, hypertension is the single most important cause of morbidity and mortality worldwide [1]. It is a major risk factor for serious health conditions, including heart disease, heart failure, stroke, peripheral vascular disease, kidney disease, pulmonary embolism, vision loss, cognitive impairment and dementia.

There are several types of hypertension (*e.g.* essential, isolated systolic, orthostatic, portal, pulmonary). Understanding the underlying mechanisms for each type at a patient-specific level is of paramount importance for an accurate diagnosis and effective treatment therapy. Computational models can help us with this understanding; *e.g.* by augmenting clinical data, providing insights into haemodynamic variables not accessible from clinical measurements, and quantifying the mechanistic role of the different elements in the system that contribute to the elevation of blood pressure. Before computational models can be safely used in the clinic, however, they need to be optimised, exhaustively tested, and ultimately validated in large clinical cohorts.

This mini-symposium focuses on the latest developments of computational models for the study of hypertension. Possible topics include but are not limited to:

- Computational models for investigating any type of hypertension;
- Patient-specific modelling: to what extent is it possible to personalise a model for the study of hypertension? Validation and robustness of patient-specific models.
- Software development for clinical applications related to the diagnosis and treatment of hypertension;
- Computational methods for accurate assessment of high blood pressure from non-invasive *in vivo* data;

- Computational methods for accurate measurement of physical properties of the cardiovascular system associated with hypertension (*e.g.* cardiac output, heart rate, arterial stiffness, venous compliance, peripheral resistance, capillary density, etc) and for quantifying their relative contributions to elevated blood pressure;
- Computational methods for the study of abnormal conditions in other systems associated with hypertension (*e.g.* the sympathetic nervous system, intrarenal renin-angiotensin system, endothelial dysfunction, etc);
- Methods of analysis based on the 1-D/0-D formulation of blood flow in compliant vessels.
- Comparison of simpler and computationally inexpensive models (*e.g.* 0-D lumped parameter models) versus more detailed, computationally expensive models (*e.g.* 3-D).

REFERENCES

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