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MECHANISTIC CARDIAC DIGITAL TWINS AND VIRTUAL COHORTS FOR INDUSTRIAL THERAPY DESIGN AND CLINICAL APPLICATIONS

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ABSTRACT

Computational models of cardiac function that are tailored to replicate key anatomical and functional characteristics of hearts of individuals or groups of patients are referred to as digital twins and virtual cohorts, respectively. These technologies are anticipated to play an important role in a spectrum of industrial and clinical applications. In the medical device industry cardiac modelling is gaining momentum as a tool for designing and optimizing cardiac device therapies using implantable devices, ablation catheters or mapping systems. Similarly in the pharmaceutical industry in silico modelling is used for drug safety assessment and the virtual evaluation of drug-based therapies. Clinical applications are being evaluated for diagnosis, stratification of risks or therapies, and even for planning therapies such as e.g. ablation in the clinic to tailor precision therapies.

While the concept of digital twins is promising, an immediate translation to cardiovascular applications in the medical sector remains challenging. Despite decades of research on biophysical modelling uptake in the medical device industry is limited, and clinical applications remain in an academic realm. To achieve translation further research is required to better cope with problems such as e.g. the complexity of workflows for creating digital twins, the lack of suitable methods for solving the ill-posed problem of inferring high dimensional parameter vectors from limited observable data, the vast computational cost of mechanistic models, and limited evidence demonstrating the trustworthiness of simulation-based predictions as the gap between processes in the physical and the virtual space cannot be accurately measured.

In this session we plan to invite speakers at the very forefront of research in creating cardiac digital twins and virtual cohorts, covering the latest developments and advances towards translation of these highly promising technologies to industrial applications in the medical device and pharmaceutical sector, and to their clinical application.