Digital twins for complex human diseases: accelerating diagnostics, prognostics and personalized care

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Digital twins, virtual copies of physical objects that have long been employed in industry and manufacturing, have emerged as a promising technology for personalised care. In biomedicine, digital twins include computational models that can simulate a patient's health state over time, enabling predictions regarding prognosis, diagnosis and treatment optimisation. Successful examples include the artificial pancreas and numerical simulation models used in cardiovascular diagnostics. Building digital twins for human pathologies is a complex endeavour requiring interdisciplinary approaches and collaboration among different stakeholders. For instance, the immune system is central to many health conditions, yet no detailed blueprint of its function exists. The immune response is complex and heterogeneous across diseases and patients, and its modelling requires the collective expertise of the international clinical, immunology, and computational modelling communities.

On May 2023, a three-week workshop on Building Immune Digital Twins (IDT) was hosted at the Institute Pascal at the University of Paris Saclay in the outskirts of Paris, France, which brought together more than 100 scientists from 19 countries to set the basis of an international IDT Working Group. The primary focus of the IDT Working Group is to create a framework that will lead to IDT implementation in both clinical and preclinical settings. We aim to develop the necessary infrastructure in a community-driven collaborative fashion, leveraging prior knowledge and achievements to accelerate development. We want to support and coordinate efforts with similarly oriented communities and foster interdisciplinary exchanges. Our community was recently selected to become a Research Data Alliance Working Group, and we are moving forward in creating an international IDT community, sending an open invitation for others to join us in this challenging yet formidable journey.