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Development of a bio-inspired blood factory for personalised healthcare

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Personalized medicine is a medical model that proposes the customization of healthcare, with decisions and practices being tailored to the individual patient by use of patient-specific information (initially genetics information) and/or the application of patient-specific cell-based therapies.

The BioBlood project (an ERC Advanced Investigator Award) aims to deliver personalised healthcare through a “step change” in the clinical field of haemato-oncology. BioBlood represents an engineered bio-inspired integrated experimental/modelling platform for normal and abnormal haematopoiesis that receives disease & patient input (patient primary cells & patient/disease-specific data) and will produce cellular (red blood cell product) and drug (optimal drug treatment) therapies as its output. Herein, we will present the experimental platform, which is a novel three-dimensional hollow fibre bioreactor capable of culturing normal and abnormal haematopoietic cells in the absence of exogenous growth factors by mimicking the structure and function of the bone marrow, alongside a population balance model (PBM) that is able to capture cellular heterogeneity and in particular leukaemia heterogeneity. The PBM, which is able to extract patient- and disease-specific information is linked to a pharmacokinetic/pharmacodynamic (PK/PD) model, which is used to optimise chemotherapy treatment in a personalised manner.

Biography

Athanasios (Sakis) Mantalaris is Professor of BioSystems Engineering in the Department of Chemical Engineering at Imperial College London. He received his PhD (2000) in Chemical Engineering from the University of Rochester. His expertise is in modelling of biological systems and bioprocesses with a focus on mammalian cell culture systems, stem cell bioprocessing, and tissue engineering. He has published over 150 original manuscripts, co-edited one book, and holds several patents with several more pending. He has received several awards including the Junior Moulton Award for best paper by the Institute of Chemical Engineers (IChemE) in 2004. In 2012, he was elected Fellow of the American Institute for Medical & Biological Engineering and in 2013 he was awarded a European Research Council (ERC) Advanced Award.

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