Arterial flow to Activated Sludge: Biomedical Computational Fluid Dynamics and Wastewater Treatment

Dr. Jim Wicks
The Fluid Group, Oxford, UK

In recent years, a significant effort has been devoted to the development of highly porous amorphous structures. Their potential mechanical and functional capabilities are of interest in many advanced technologies, from transportation, to catalysis or tissue engineering. Understanding these materials is a challenge for any computational technique; understanding how these materials interact with the human body and creating a patient-specific human geometry, adding chemistry, fluid-structure interaction, a hindered movement of solids and a non-Newtonian fluid, is a formidable obstacle to overcome. Computational fluid dynamics (CFD) offers a flexible framework where biological models which incorporate atomistic structure (from neutron, X-ray diffraction and NMR) can be added to a chemical engineering platform which includes magnetic fields and nanoparticulate transport. Unlikely as it might seem, one of the closest parallels is wastewater treatment where recent advances in computational fluid dynamics have added biokinetics and Lagrangian solids transport alongside multiphase hydraulics. Specific examples of this cross-disciplinary cross-over will be presented and the complimentary use of experimental and modelling results to predict complex natural phenomena explored.