CompBioMed

A Centre of Excellence in Computational Biomedicine

e-Seminar Series

e-Seminar #24
Simulating human cellular blood flow at extreme detail: a drop of blood at exascale

5 July 2022 2pm CEST / 1pm BST (1h duration)

Register for free here: https://register.gotowebinar.com/register/6331311026593249 44

Blood is the single most important fluid in the human body. It has an important role in most healthy and pathologic processes. Yet many of its properties are poorly understood primarily due to its complex cellular nature. It is composed of a dense suspension of deformable cells and various proteins suspended in blood plasma.

To reduce complexity, blood is usually simulated as continuum fluid with empirical rheology curves. However, in recent years our understanding in many physiologic processes and diseases has reached the point where more detailed description of blood is necessary.

In the following talk I will introduce a numerical method designed for high-performance computations that model blood accurately on the cellular level. The dynamics, collision, and deformation of every red blood cell is resolved every microsecond by approximately 5000 equations. I will introduce the computational challenges and solutions that allow an efficient simulation of these intricate details of blood and demonstrate how this solution can scale over a quarter million CPU cores.

Finally, I will show a set of examples on how these novel large-scale simulations contribute to clinical and in vitro experimental research, leading to better understanding of the respective investigated pathologies.

This is the 24th in a series of online e-Seminars organised by CompBioMed.

Watch the full series at www.compbiomed.eu/training!

Gábor Závodszky is an assistant professor of multi-scale computing at the University of Amsterdam and assistant professor at the Budapest University of Technology. His research focuses on designing and developing detailed high-performance computational models targeting cardiovascular diseases. He maintains active interdisciplinary collaborations with several clinical institutes and experimental labs across Europe. He is currently work package leader in CompBioMed (H2020). He is coordinating the development of HemoCell, the open-source cellular blood flow simulation framework, that is being used by several research groups and is deployed in more than a dozen HPC centres around the World. He also developed virtual device deployment simulations for endovascular aneurysm treatments which are currently being used as clinical decision-making support tools.

Moderated by Tim Weaving, **UCL**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 823712.

Organised in collaboration with: Avicenna Alliance Association for Predictive Medicine, VPH Institute Building the Virtual Physiological Human