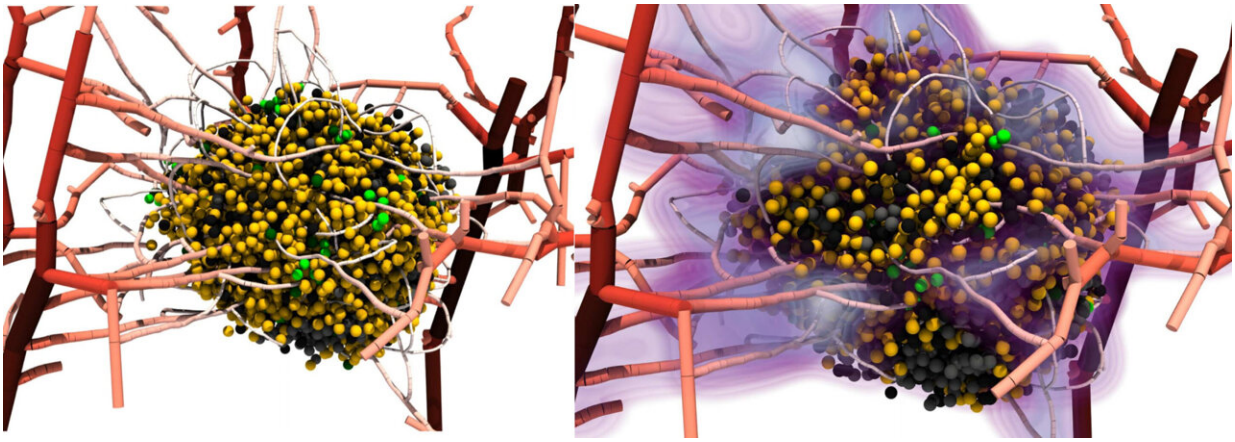
Mathematical model mimics vascular tumor growth in breast cancer and its response to treatment

January 16 2024, by Marina Banjac



Final tumour before treatment (left) and at early stage of treatment (right). Credit: *Computer Methods in Applied Mechanics and Engineering* (2023). DOI: 10.1016/j.cma.2023.116566

Choosing the right cancer treatment is a massive undertaking involving multiple stages, high experimental complexity and significant costs. Currently, two main methods are used to find the best possible treatment solutions: in vitro testing and clinical trials. However, predicting the drug effects on each individual patient remains the Holy Grail of personalized medicine.

Born from CERN openlab in the CERN IT department, BioDynaMo is an innovative tool for in silico testing, i.e., experimentation carried out on a computer. Based on mathematical models, it creates and runs complex 3D computer simulations that help understand cancer progression and identify the most effective treatment strategies for specific tumor cases.

In a recent publication in *Computer Methods in Applied Mechanics and Engineering*, scientists affiliated with CERN, the Technical University of Munich and the University of Texas at Austin demonstrated the significant potential of advancing medical therapy with the help of BioDynaMo.

The model successfully replicates medical data on recorded tumor growth and the effects of two anti-cancer drugs, Doxorubicin and Trastuzumab. By fitting the BioDynaMo models to the available pre-clinical data, scientists proved the platform's ability to simulate different levels of efficacy of various drugs, treatment combinations and dosage regimens.

BioDynaMo is an open source project that strives to provide the most efficient and performant simulation platform for agent-based models. It accommodates a diverse range of use cases and can address research questions in oncology, neuroscience, epidemiology and many more disciplines. With its ability to simulate almost 2 billion agents (or cells), BioDynaMo is a powerful tool for analyzing many different complex systems.

Since 2015, BioDynaMo's consortium of scientists has been working on developing and optimizing the engine, improving its performance and usability.

More information: Tobias Duswald et al, Bridging scales: A hybrid

model to simulate vascular tumor growth and treatment response, *Computer Methods in Applied Mechanics and Engineering* (2023). DOI: 10.1016/j.cma.2023.116566