

# **Mathematical hematology: Mathematical modelling, simulation and analysis to understand cancer heterogeneity and resistance to therapy**

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The talk is devoted to mathematical modelling of acute leukemias that are cancerous diseases of the blood forming system. They are derived from a small population of leukemic stem cells that out-compete hematopoietic stem cells which are required for blood cell formation. Experiments suggest that differences in the interaction between healthy and malignant cells contribute to the observed among-patient heterogeneity. These interactions include leukemic cell response to long-range feedbacks, e.g., hematopoietic growth factors and competition of stem cells for spaces in a supportive stem cell niche. We use a combination of analytical results, computer simulation and patient data analysis to explore the role of cellular hierarchies and within-tumour heterogeneity of the disease and their impact on the patient prognosis. Mathematical models in form of ordinary, integro- and partial differential equations prove to be a powerful tool to address clinically relevant questions.