Mathematical inference unveils the dynamics of hematopoiesis in mice and humans

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Hematopoietic stem cells (HSCs) give rise to a great variety of cell types, serving oxygen transport, blood vessel integrity and immune defense. How these stem cells function in the intact, healthy organism has long remained enigmatic, as they are small in number and hidden in the bone marrow. Recent progress has been made by using mathematics to interpret in vivo data on HSC differentiation and proliferation activity and predict the outcome of new experiments. In the first part of my talk, I will show how non-invasive genetic labeling and barcoding approaches in mice have allowed the mathematical inference of the physiological differentiation dynamics of HSCs and downstream progenitors in steady state and under stress. In the second part, I will show how somatic mutations can be used as markers for the HSC dynamics in humans, shedding light on how these dynamics shape the risk to develop leukemia.