# Popular science summary

Degree project in Immunotechnology, KIMM01, LTH MSC in Biotechnology

**Secretome-to-transcriptome linkage of bone marrow niche cells at single-cell resolution**

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What is causing our blood cell production center to be less efficient as we age? Hematopoietic stem cells (HSCs) are essential for producing all types of blood cells - red blood cells, white blood cells, and platelets. These stem cells first develop in the embryo before migrating to the bone marrow, where they sustain blood production throughout adulthood. HSCs remain mostly in a resting state in the bone marrow, which helps protect them from damage. However, when the body needs more blood cells—such as during illness—HSCs become activated and begin producing differentiated blood cells. As we age, HSCs gradually become less efficient, paving the way for various health problems, such as cardiovascular diseases and blood cancers.

HSCs don't function alone in the bone marrow; they depend on an environment known as the bone marrow niche, which acts as their support system. This niche is made up of various cell types that provide the necessary signals for HSC survival, multiplication, and differentiation. The niche is a complex and heterogeneous environment that we still don't fully understand. As the body ages, the bone marrow environment undergoes changes, and these alterations can negatively affect the ability of HSCs to produce healthy blood cells.

To better understand these changes, we need advanced experimental techniques. My thesis work enabled the first implementation of a novel technique at Lund University, combining single-cell RNA sequencing with Nanovials, which allowed us to analyze both gene activity and protein secretion in individual mouse cells. Single-cell RNA sequencing enables us to examine the specific gene activity in each cell, while Nanovials capture the proteins secreted by these cells, providing insight into which cells are producing the most important molecules for HSC function. By combining these tools, we can gain a deeper understanding of how aging affects individual cells and how gene expression and secretion are connected. Ultimately, this research may pave the way for new treatments for age-related blood disorders in humans.