Barcodes show the blood family tree

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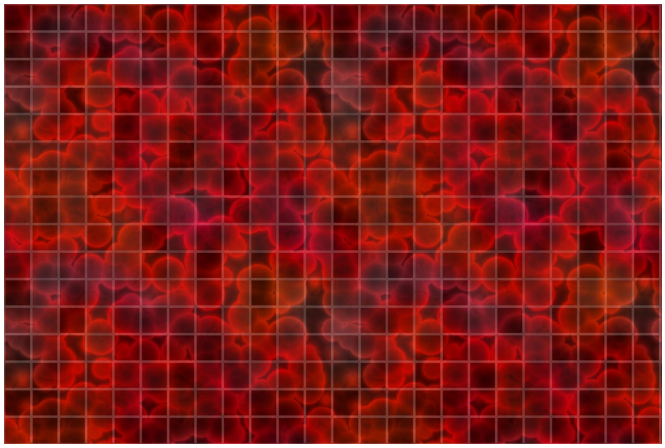

Blood cells texture. Credit: MostPhotos

By assigning a barcode to stem cells, researchers at Lund University in Sweden have made it possible to monitor large blood cell populations as well as individual blood cells, and study the changes over time. Among other things, they discovered that stem cells go through different stages where their ability to restore immune cells varies. The new findings provide important information for the research and treatment of leukaemia and autoimmune diseases.

Studies in mice suggest that some of our white blood cells are only formed during the foetal period, and stay with us for the rest of our lives. The blood stem cells in the embryo are particularly capable of maturing into a proper immune system, and the question as to why they do not continue to do so in adults has been discussed among researchers for a long time. A research group at Lund University is now one step closer to finding the answer.

"By assigning a 'barcode' to the stem cells, we were able to track their performance over long periods of time and see which cells in the blood and the immune system they can induce. Without the barcode, we only see a bunch of red and white blood cells, without knowing how they are related. This allows us to track which stem cell has given rise to which subsidiary cells, and thereby distinguish the family tree in the blood", explains Joan Yuan, research group leader.

The barcodes enable researchers to see how individual stem cells in the blood differ from one another, and how their functions change with age. In terms of white blood cells, which are only formed in the embryo, one of the theories has been that they originate from specialised stem cells that are only active during foetal life. With the help of barcodes, the research group has been able to show that this is not the case:

Barcode. Credit: MostPhotos

"The same stem cells exist within adults, but they have lost their ability to regenerate the entire immune system. By adding a protein normally only found in the stem cells of a foetus, we were able to reconstruct their capacity to produce white blood cells", says Trine Kristiansen, doctoral student and lead author of the study, which was recently published in the journal *Immunity*.

The researchers' discovery shows that the stem cells undergo various stages in which their ability to reproduce all types of immune cells changes. In

other words, it is possible to turn back the clock and with the help of protein recreate a foetal-like status. The studies which have been done in mice, are relevant for humans.

"This information could become significant in cases of leukaemia, for which one of the treatment methods involves a bone marrow transplant. In this treatment, the patient's blood system is replaced with that of an adult donor, which could mean losing the B cells that are only produced in foetuses", continues Trine Kristiansen.

Without these antibody-producing white blood cells, the immune system is no longer complete, and the individual becomes increasingly at risk of developing immune system disorders that can lead to severe infections and autoimmune diseases, as the blood cells produce special antibodies that have the important function of removing dead cells from the body.

"Every day millions of blood cells die, and they can emit DNA and other debris that cause inflammation if not taken care of by the white blood cells. The discovery is a step towards understanding which processes create a proper immune system for those who suffer from blood diseases", concludes Elin Jaensson Gyllenbäck, one of the researchers behind the study.

More information: Trine A. Kristiansen et al, Cellular Barcoding Links B-1a B Cell Potential to a Fetal Hematopoietic Stem Cell State at the Single-Cell Level, *Immunity* (2016). DOI: 10.1016/j.immuni.2016.07.014

Provided by Lund University

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