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Commentary

A Brief Note on Hematopoietic Stem Cell

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DESCRIPTION

Hematopoietic Stem Cells (HSCs) are cells found in bone marrow and blood. HPCs are accomplished of making mature blood cells, such as red blood cells (the cells that carry oxygen), platelets (the cells that help stop bleeding) and white blood cells (the cells that fight infections).HPCs are used in the treatment of malignant (e.g. , leukemia, lymphoma) and non-malignant (e.g., sickle cell disease) diseases to rebuild a patient's hematopoietic system. This type of treatment is known as stem cell transplant. HPCs also used in clinical trials for the treatment of autoimmune diseases , genetic diseases and other indications. For some diseases stem cell transplant may be an option.

Hematopoietic Stem Cells (HSC) are considered by their extensive self-renewal ability and pluripotency. The chances of asymmetric versus symmetric separation of HSC can be stochastically influenced by outer signals. There are many *in vitro* systems associating either bone marrow stromal support of a combination of recombinant hematopoietic growth factors and both that can maintain HSC proliferation and variation over many weeks. However, the goal of significant expansion of the HSC population *in vitro* has proved more elusive. There has been a volatile increase in knowledge of the cellular and molecular bases of HSC regulation with the identification of pathways implicating Notch, Wnt, and Hedgehog as well as the cytokine signaling through the c-Kit, Flt3, IL-6-R, mpl, and Tie-2 receptors and downstream pathways involving Jak/STAT and homeobox proteins.

There is considerable idleness in pathways regulating HSC, and both preservative and synergistic connections between different pathways define the balance between self-renewal and differentiation. With the identification of definite niches within the bone marrow, including endosteal and endothelial, it is now known that close interactions between HSC and regulatory components of the marrow microenvironment such as osteoblasts, osteoclasts, granulocytes, mesenchymeal cells, endothelium etc. determine HSC proliferative status, differentiation, pool size, and mobilization. The relocation of HSC between different niches and the vascular section is controlled by the chemotactic activity of stromal derived chemokine SDF-1 acting through its receptor CXCR4, in combination with CD44 and hyaluronic acid. The release of various proteases within the marrow environment results cleavage of stromal and HSC-associated adhesion molecules, receptors, cytokines, and chemokines, providing a further stage of regulation.

James Thomson and Thomas Okarma proposed a theory which is human ESCs will provide a potentially limitless source of cells, distinguished *in vitro*, for transplantation therapies including the liver, nervous system, and pancreas. If HSCs derived from human ESCs could be fruitfully transplanted into the blood system of a transplant receiver, any further implant tissue (kidney or pancreas) developed with the same ESCs would not, in concept, be excluded by the recipient because the immune cells produced in the recipient's blood by the HSCs would see the implant tissue as "self". ESCs in tissue culture increases to a mixture of cell types all at once, and biochemical, tissue-culture, and molecular-biology techniques to control and limit variation need much investigation.

Transplantation of Hematopoietic Stem Cells (HSCs) expresses promising view for broad-spectrum hematological disorder therapy, due to their capability to form the entire hematopoietic lineages. However, the restricted number of HSCs in both bone marrow and umbilical cord blood limits their widespread use. Hence, there is great interest in developing methods for *ex vivo* expansion and thus self-renewal of HSCs. Strategies based on nanomaterials or nanotechnologies seem hopeful to expand HSC numbers more efficiently and tune their properties *ex vivo*.

HSCs were found to possess inimitable properties that fixed them apart from other blood-forming ancestor cells. In addition to the properties of pluripotency and self-renewal, adult long-term HSCs were found to exist in a definite place environment in the bone marrow, which was closely associated with endosteum and where they exist in conditions of relative hypoxia.

Here, HSC exists mainly in a non-replicative and inactive state in which signing by the cytokine thrombopoietin and the existence of megakaryocytes are recognised to have an important role.

In contexts that place the haematopoietic system under pressure, such as chronic infection, these inactive stem cells are hired into cell cycle, for example through interferon signalling, which is associated with a statistical increase in downstream ancestor cells.

Although murine haematopoiesis imitates human haematopoiesis in numerous ways, the immunophenotypic markers of human HSCs (Lineage-CD34+CD38-) vary from functionally alike murine counterparts. Unlike inbred immunologically and

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genetically indistinguishable mouse strains, successful allogeneic transplantation therapy in humans needs major immunological barriers to be overcome.

CONCLUSION

The finding of the HLA system of MHC class I and II receptors, which involve T-cell antigen receptors, permits histocompatible similarity of recipients and donors. This is supplemented with the use of immunosuppression during and after the transplantation of allogeneic stem cells from volunteer-related and -unrelated donors. Progression of stem cell transplantation therapy has focussed on research to widen the accessibility of donors to patients. Use of cord blood units as a source of stem cells, immunosuppressive regimens and newly established conditioning have allowed haploidentical transplantation to develop a therapeutic certainty while preventing the immunological importance of graft-versus-host disease. These methods are gradually making the option of allogeneic transplantation obtainable to patients who otherwise do not have a matched related or volunteer-unrelated donor source of stem cells.