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Hematopoietic Stem Cells and its Self-Developing Process

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Description

Hematopoietic Stem Cells (HSCs) are the stem cells from which other blood cells develop, this is known as hematopoiesis. The first definitive HSCs in vertebrates develop from the ventral endothelial wall of the embryonic aorta within the (midgestational) aorta-gonad-mesonephros region, a process known as endothelial-to-hematopoietic transition. Hematopoiesis occurs in adults in the red bone marrow, which is found in the centre of most bones. The red bone marrow is derived from the embryonic layer known as the mesoderm [1,2].

The process by which all mature blood cells are produced is known as haematopoiesis. It must strike a balance between enormous production and the need to regulate the number of each blood cell type in circulation. The vast majority of hematopoiesis in vertebrates occurs in the bone marrow and is derived from a limited number of multipotent and self-renewing hematopoietic stem cells.

Hematopoietic stem cells give rise to various types of blood cells, including myeloid and lymphoid lines. Dendritic cell formation involves both myeloid and lymphoid lineages. Monocytes, macrophages, neutrophils, basophils, eosinophil's, erythrocytes, megakaryocytes, and platelets are all examples of myeloid cells [3]. T cells, B cells, natural killer cells, and innate lymphoid cells are all lymphoid cells. Since the discovery of hematopoietic stem cells in 1961, the definition of HSC has evolved. The hematopoietic tissue contains committed multipotent, oligopotent, and unipotent progenitors as well as cells with long-term and short-term regeneration capacities.

During (mouse and human) embryonic development, the aorta-gonad-mesonephros region, as well as the vitelline and umbilical arteries, contain the very first hematopoietic stem cells. HSCs are later discovered in the placenta, yolk sac, embryonic head, and foetal liver.

Adult bone marrow contains hematopoietic stem cells, particularly in the pelvis, femur, and sternum. They can also be found in umbilical cord blood and, to a lesser extent, peripheral blood. Using a needle and syringe, stem and progenitor cells can be extracted from the pelvis at the iliac crest. The cells can be removed as liquid (for a smear to examine the cell morphology) or as a core biopsy (to preserve the architecture or relationship of the cells) [4].

Because hematopoietic stem cells cannot be isolated as a pure population, they cannot be identified under a microscope. Flow cytometry can be used to identify or isolate Hematopoietic stem cells, which use a combination of several different cell surface markers to separate the rare Hematopoietic stem cells from the surrounding blood cells. Lin-cells are hematopoietic stem cells that lack the expression of mature blood cell markers.

The absence of lineage markers, combined with the detection of several positive cell-surface markers, is used to isolate hematopoietic stem cells. Furthermore, hematopoietic stem cells are distinguished by their small size and low staining with vital dyes like Rhoda mine 123.

HSCs (Hematopoietic Stem Cells) give rise to all types of blood cells and self-renew. The ability of HSCs to regenerate has already been successfully translated into clinical applications. However, recent studies on the biology of HSCs suggest that their clinical use may be expanded in the future.

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