

Chronic Myeloid Leukemia

Chapter 1 Hematopoietic Stem Cell

Blood cell production comes from self-renewing stem cells.¹ Self-renewal ensures that stem cell reserves are not exhausted.² Chronic Myeloid Leukemia (CML) begins in the bone marrow where these new blood cells are made. A small portion of the blood-forming cells are blood stem cells. These stem cells can sometimes become abnormal in individuals who have CML.³

Hematopoietic stem cells are at the top of hematopoietic hierarchy and produce nine different types of functional effector cells. Most effector cells have a short life span, so mature blood cell production is an ongoing process. The high turnover rate requires homeostatic control mechanisms which resides primarily with the hematopoietic stem cells. Progenitor cells within the hematopoietic hierarchy take on significant homeostatic control, as well. Progenitor cells are incapable of prolonged self-renewal, so a branching design takes place in the hematopoietic hierarchy where progenitors give rise to more progenitors that have more restricted developmental potential.²

The hematopoietic stem cell is the only stem cell in the body that is clinically applied in the treatment of disease like breast cancer, leukemias, and congenital immunodeficiencies.⁴ Studies suggest that normal primitive cells are the target for leukemic transformation instead of committed progenitor cells.⁵ Hematopoietic stem cells maintain stem cell function after transplantations or chemotherapy.²

Chapter 2 Myeloproliferative Neoplasm

Chronic myeloid leukemia is a myeloproliferative neoplasm (MPN). MPNs are blood cancers that occur when the body makes too many white or red blood cells, or platelets. Blood cell production takes place in the bone marrow. Overproduction of blood cells can be problematic and impact blood flow.^{6,7} CML develops from the neoplastic transformation of a hematopoietic stem cell.⁸

There are several other types of MPNs which are chronic neutrophilic leukemia, polycythemia vera, primary myelofibrosis, essential thrombocythemia, chronic eosinophilic leukemia, not otherwise specified, and MPN, unclassifiable. Individuals with myeloproliferative neoplasms may live for many years after they are diagnosed. Treatment plans depend upon the type of myeloproliferative neoplasm.^{6,9}

Chapter 3 Myeloid Cells

Blood stem cells can develop into either lymphocytes or myeloid cells. Myeloid cells eventually become either red blood cells, white blood cells, or platelets. These myeloid cells are abnormal in individuals with CML.³ Chronic Myeloid Leukemia develops because of an increase in the number of myeloid cells in the marrow and an arrest in their maturation. This often results in hematopoietic insufficiency, with or without leukocytosis. Poorly differentiated myeloid cells are a result of chromosomal translocations and mutations in the genes responsible for hematopoietic proliferation and differentiation. The clonal expansion of undifferentiated myeloid precursors can impair hematopoiesis and cause bone marrow failure.⁵